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A TWO-YEAR SURVEY OF BENZO(a)PYRENE AND BENZO(k)FLUORANTHENE IN URBAN ATMOSPHERES IN ONTARIO

March 1976

Ministry of the Environment
Ontario

The Honourable George A. Kerr, Q.C., Minister

Everett Biggs, Deputy Minister

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Ontario Ministry of the Environment
Laboratory Services Branch
Air Quality Laboratory

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INDEX

PAGE

ABSTRACT

FOREWORD..... 1

OBJECTIVES OF WORK..... 2

INTRODUCTION..... 3

ANALYTICAL..... 5

1) Extraction of High-Volume Filters..... 10

a) Solubilities of PAH..... 11
b) The Effects of Solvents on Fluorescence..... 13
c) Soxhlet Extractions of High-Volume Filters..... 15
i) Extracted Organic Matter ("Organics")..... 15
ii) Rate of Extraction..... 19
iii) Benzo(a)pyrene in Soxhlet Extracts..... 22

2) The "Indirect Method" for BaP and BkF Analysis..... 25

a) Principle of Method..... 25
b) Interferences and Shortcomings..... 25
c) Apparatus..... 27
d) Reagents..... 28
e) Procedure..... 29
I) Extraction of High-Volume Filters..... 29
II) Preparation of Chromatographic Column..... 29
III) Preparation of Standard Solutions..... 30
IV) Chromatography of Standard Solutions and Filter Extract..... 31
V) Fluorometric Determination of BaP and BkF.... 32
f) Calculation and Reporting..... 33
g) Precision and Accuracy..... 33
h) Safety Precautions..... 34

3) The "Direct Method" for BaP and BkF Analysis..... 35

SURVEY OF BaP AND BkF..... 50

1) Extent of Survey..... 50

a) Station Location and PAH Level..... 53
i) "Industrial"..... 53
ii) "Residential and Business"..... 57
iii) "City Traffic"..... 58
iv) "Petrochemical"..... 58
v) "Ore-Processing"..... 59

Cont'd

INDEX (cont'd)

2) Time Period of Sampling and PAH Level..... 77
3) Influence of Wind Direction on PAH Level..... 91
4) Influence of Wind Speed on PAH Level..... 92
5) Coefficient of Haze and PAH Level..... 94
6) Amount of Dust (Airborne Particulates) and PAH Level... 96
7) Temperature Inversion and PAH Level..... 97
8) Colour of Air Particulate Extract and PAH Level..... 107

SPECIAL STUDIES..... 179
1) City Traffic and PAH Level..... 179
2) Particle Size and PAH Level..... 182
3) Roof-Tarring and PAH Level..... 184
4) Fire in City and PAH Level..... 185
5) BaP and BkF Levels in Vicinity of Steel Plant..... 187
6) BaP and BkF Analyses not Included in This Report..... 189
7) Examples of PAH Levels in Other Countries..... 190

CONCLUSIONS AND RECOMMENDATIONS..... 193
1) Welland..... 193
2) Hamilton and Sault Ste. Marie..... 194
3) Windsor..... 196
4) Toronto and Ottawa..... 196
5) Cornwall and Sarnia..... 197
6) Periods of Temperature Inversion..... 198
7) Temporary and Localized Pollution by PAH Compounds..... 198
8) Seasonal and Environmental Influences..... 199

Cont'd

INDEX (Cont'd)

9) Other Considerations.....201

ACKNOWLEDGEMENTS.....203

BIBLIOGRAPHY.....204

ABSTRACT

Two analytical methods suitable for determining and monitoring two important polynuclear aromatic hydrocarbons (PAH) in airborne particulates have been developed. These hydrocarbons are benzo(a)pyrene, a most potent carcinogen, and benzo(k)fluoranthene, a related compound indicative of the presence of other PAH. By using these methods, a two-year programme, covering the period from July 1971 to July 1973, was carried out for measuring these compounds in the atmospheres of eleven urban communities.

The survey revealed that Welland had by far the highest PAH levels of all communities investigated with the industrialized cities of Hamilton and Windsor (vicinity of Detroit) following next in line. By comparison with certain cities in foreign countries, these levels seemed rather high, while other industrial communities, such as Toronto, Cornwall, Sarnia and Sudbury, showed relatively low PAH levels.

With the aim of establishing the underlying causes for the pollution levels observed, attempts were made to correlate these levels with a number of environmental conditions. In industrial areas, certain wind directions were found to coincide with peaks in pollution levels, which suggested or confirmed offending emission sources. Periods of temperature inversions over large areas of Ontario were invariably marked by a surge in PAH levels up to eight times the average levels. Incidences of high PAH levels were also caused by local events, such as city fire, roof and road-tarring operations and downtown traffic. Correlations of the observed PAH levels with coefficient of haze values, with levels of airborne particulates and with annual and seasonal changes were examined for all communities.

FOREWORD

The aim of this report is to cover the work done in preparing and conducting a two-year survey of polynuclear aromatic hydrocarbons in urban atmospheres in Ontario, to indicate the direction taken in pursuit of the objectives of this project, the analytical methods adopted and developed, and the conclusions and recommendations derived from the results. Four reports have previously been issued by the Air Quality Laboratory Section on certain aspects of this project, the essential parts of which are included in the present report. The subjects (or titles) of these reports are the following:

a) The determination of benzo(a)pyrene and benzo(k)-fluoranthene in airborne particulates (1).

b) An efficient separation of benzo(a)pyrene from benzo(k)fluoranthene and their fluorometric determination in air samples (2).

c) Polynuclear aromatic hydrocarbons in urban atmospheres in Ontario: An interim Report (3).

d) Benzo(a)pyrene and benzo(k)fluoranthene in urban atmospheres in Ontario: First Annual Report (4).

By including the pertinent contents of these studies for purposes of evaluation and comparison with the results of the now available second-year survey, this summary report represents a comprehensive account of the entire project. Work done during this period outside the scope of this project, or which was considered of little consequence to its objectives, is not included in this report.

OBJECTIVES OF WORK

In line with the general aim of developing feasible analytical methods for the routine determination of carcinogenic air pollutants and of monitoring these pollutants in air samples, the following objectives had been proposed:

a) To explore and establish methods for the reliable, fast routine determination of polynuclear aromatic hydrocarbons on High-Volume air filters. To direct attention to the determination of those air pollutants which are most potent as carcinogens and which appear to be most prevalent and representative of this group of compounds.

b) To initiate and carry out a programme for studying the occurrence and distribution of these compounds in the air of major population and industrial centres in Ontario.

c) To relate the concentration levels of these air pollutants with meteorological, topographical and man-generated influences; to attempt to establish the cause(s) for high polynuclear aromatic hydrocarbon levels in urban communities.

INTRODUCTION

In recent years there has been increasing concern about the possible harmful effects of organic compounds in the environment. An important class of pollutants are the polynuclear aromatic hydrocarbons (PAH), of which a number of compounds have been shown to possess carcinogenic (5-8) and mutagenic(9,10) properties. Benzo(a)pyrene (BaP), in particular, has been singled out as a most potent carcinogen (11,12,13) and results of investigations on the relation between air pollutant levels (as indexed by BaP) and lung cancer death rate have recently been published(14).

The presence of BaP and other related compounds in air has been traced to a variety of sources, all of which involve heating, burning, incineration or other combustion processes of carbonaceous materials. Because of the significance which had been attached to BaP among the large number of polynuclear hydrocarbons formed, this compound has frequently been used as an index of carcinogenic potential for comparison with other members of this group(15), and also has been proposed as an index for total polynuclear aromatic hydrocarbons in air. Work aimed at the establishement of such an index for PAH is presently in progress in this laboratory(16).

We have selected BaP as the main target in this survey for reasons quoted or established by other investigators(15,17) that this compound is regarded as potentially the most harmful

polynuclear aromatic hydrocarbon, that it is widespread in its occurrence in urban air, and that it is chemically and physically a representative member of its group.

An exception in our methods development programme was made by including benzo(k)fluoranthene (BkF), for which no convincing evidence of carcinogenic properties has yet been established (18). This compound, which is another polynuclear aromatic hydrocarbon, however, was found in every air sample analysed in which BaP was present, and usually at higher concentration (19). Since separation of BaP from BkF is not possible without using elaborate separation techniques, BkF must be determined out of analytical necessity in order to avoid erroneously high values for BaP. It was, therefore, automatically included in the survey. Of course with BkF being another representative member of this important group of compounds, its quantitation provides further insight into the occurrence and distribution of the polynuclear aromatic hydrocarbons in general.

ANALYTICAL

Numerous methods have been developed for the determination of polynuclear aromatic hydrocarbons (PAH) present in air in trace quantities. Common to virtually all these methods is the extraction of an organic portion of air particulate material containing these compounds.

Subsequent separation of these chemically similar and mutually interfering compounds is required to enable quantitative determination of individual compounds such as BaP and BkF. Much painstaking and time-consuming work is involved in most methods by which such separation is accomplished (20,21). By complex chromatographic procedures, involving low and high-pressure column and two-dimensional thin-layer chromatography, sufficient fractionation of High-Volume filter extracts may be achieved to permit quantitative determination of some of the compounds thus separated (22,23,24).

Methods using paper-chromatography have been developed but this separation technique has found little more than academic interest (25,26). Gas-chromatographic methods which usually offer the quickest route to analytical results, have suffered invariably under the suspicion of thermal degradation of the high-boiling polynuclear hydrocarbons at the high column temperatures required (27-31). Micro-distillation and micro-sublimation (32,33) are also procedures which have been used but only with limited success.

Thus, most separation procedures are afflicted with considerable handicaps and only elaborate and multi-step operations, such as column-chromatographic and thin-layer chromatographic separations, are likely to be satisfactory in separating PAH components quantitatively. While the quantitative separation of PAH components is generally desirable, there can be exceptions depending on the method of determination and the pollutant analyzed.

For the final step of determining the separated compounds, a number of instrumental methods have been employed which include colorimetric, absorptiometric, fluorometric and mass-spectrographic techniques. Colorimetric and absorptiometric methods have widely been used and the absorption at 399-402-405 nm was found somewhat more specific for BaP than that at other wavelengths (22,34) but, unfortunately, at the expense of greatly reduced sensitivity (35).

Moreover, other serious disadvantages have critically limited the usefulness of all absorptiometric methods. Under normal sampling conditions for urban air, multiples of High-Volume filters rather than a fraction of one filter per analysis, is required. The use of expensive spectrograde solvents in amounts of several liters per analysis is also a great disadvantage, especially since they are unlikely to be recoverable for repeated use. A single BaP determination carried out by an experienced worker requires reportedly as much as two days (22,40,41) which would render the method impractical for monitoring purposes. Finally absorptiometric measurements for

BaP were found to be subject to interference by BkF (36) and other compounds. BkF was reported to be a constant companion of BaP in air samples and to have similar chromatographic retention times (19). This finding has cast doubt upon the validity of earlier results from analyses of BaP on High-Volume filters (37). Studies on the comparison of analytical methods for the analysis of PAH and specifically for BaP (37,38) conclude with the recommendation to abandon the use of absorptiometric methods entirely in favour of the more promising and more sensitive fluorometric methods. Nevertheless, in the absence of better methods, one absorptiometric method has been accepted as a standard procedure: "Method of Test for Polynuclear Aromatic Hydrocarbons in Air Particulate Matter" by the ASTM (39).

Data provided by absorptiometric methods in 1961 for the occurrence of BaP and other PAH compounds in urban air in Ontario (42) and in 1958 in the atmospheres of various cities in the U.S.A. (43), are still significant since they permit an evaluation for the areas involved on a comparative basis even though the absolute values of the data obtained seem now in question.

In another method, proposed in 1974 as "Tentative Method of Analysis for Polynuclear Aromatic Hydrocarbons in Automobile Exhaust" by the ASTM, chromatographic separations are required prior to ultraviolet absorptiometric measurements of the components in combination with a carbon - 14 radioactivity count of added radio-tracer compounds (44). This method would also seem to be impractical for application to large-scale monitoring.

Recently, fluorometric techniques for determining PAH have been the subject of intensive studies whereby the overwhelming advantages of these techniques over the absorptiometric approach have become evident. The sensitivity of fluorometric methods is about 300-3000 times greater than that of absorptiometric methods and consequently small sample sizes (fractions of a High-Volume filter) can be employed.

Fluorescence is, in general, a more specific property of matter than absorption since fluorescence is exhibited by only relatively few groups of compounds, such as the PAH compounds. Thus, fluorometric methods may require less elaborate separation techniques, which can result in considerable time and labour savings.

Methods have also been developed which combine both absorptiometric and fluorometric techniques for the determination of a number of polynuclear hydrocarbons (20,41). These methods, however, involve the necessity for elaborate chromatographic separations.

An efficient method for monitoring BaP on High-Volume filters was developed by Monkman and co-workers and was based on fluorometry alone (19). BaP and BkF were separated from all other components in the filter extract by simple column-chromatography, followed by fluorometric analysis of the chromatographic fractions. By using two different excitation wavelengths and one common emission wavelength, it was found possible to estimate

these two compounds by an indirect approximation technique. The method was recently proposed as a "Tentative Method of Chromatographic Analysis for Benzo(a)pyrene and Benzo(k) fluoranthene in Atmospheric Particulate Matter"by the Inter-Society Committee (45).

Very recently, mass spectrometric analysis has begun to play an important role in the identification of PAH compounds and there is evidence that this technique could be developed for the quantitative determination of PAH in air samples (46,47,48). However, apart from the high investment expenditure (above $100,000) and high maintenance costs for a computerized mass-spectrometric system, this technique still requires an efficient chromatographic separation step, which is usually the most difficult and the most time-consuming part of the analysis.

Because of its speed, sensitivity and suitability for monitoring BaP and BkF in air samples, the fluorometric method of Monkman et al. (19), was adopted for use in the present survey work with only minor modifications and some streamlining of procedures for making it more suitable for large numbers of samples. Because of the interrelated and indirect way in which BaP and BkF, in the presence of each other, are determined by this method, it is referred to in this report as the "Indirect Method".

In order to permit the determination of BaP and BkF independently from each other and at any concentration, a new separation technique (2) was also developed which,

coupled with provisions for simultaneous and continuous fluorometric measurement, could be applied as needed on relatively few, exceptional occasions in this survey work. This new method is described as the "Direct Method" in this report.

Both the "Indirect" and "Direct" methods use the same extraction procedure, but differ in the manner of separating and determining PAH compounds.

1. Extraction of High-Volume Filters

Various factors which may influence the extraction of PAH from air particulate matter were studied. Since BaP and BkF have high melting points and relatively low vapour pressures they are collected together with airborne particulate matter on 8 x 10 inch glass-fibre filters which are normally used to sample about 2200 m^3 of air during a 24-hour period.

Therefore, an extraction step is necessary by which most of the organic material, including virtually all BaP and BkF with other PAH compounds, is recovered from the High-Volume filter by an organic solvent. The organic extract is then subjected to column chromatography, and the fractions containing BaP and BkF are taken for fluorometric measurement.

For the purpose of extracting PAH compounds, such as BaP and BkF, from High-Volume filters as quantitatively as possible, with a minimum of decomposition, and without extracting

excessive amounts of other compounds (organic or inorganic), a wide variety of organic solvents has been proposed. Perhaps the most predominantly used solvents today are cyclohexane (preferred in Canada) and benzene (in the U.S.A.) although other solvents are still being used and may possess advantages of their own (19,37).

a) Solubilities of PAH

A brief investigation was made on the efficiency of various organic solvents for the extraction of PAH from High-Volume filters. The solubilities of a number of PAH compounds were determined by mixing 2-5 mg quantities with gradually increasing volumes of the solvent to be investigated until complete solution was accomplished. The solubilities found for a number of these hydrocarbon compounds in various solvents at room temperature are shown in Table 1.

From the results in Table 1, it is evident that a wide range of solubilities exist for the various PAH compounds in the same solvent. However, it is not possible to deduce any direct relationship between solubility and number of aromatic rings in the molecule, although the larger molecules are generally more soluble. By comparing the solubilities of the same PAH compound in different organic solvents, a wide range of solubilities is also noticeable.

TABLE 1

SOLUBILITIES OF POLYNUCLEAR HYDROCARBONS IN ORGANIC SOLVENTS

Solvent	Anthracene 3 rings	Chrysene 4 rings	Pyrene 4 rings	Benzo(a)pyrene 5 rings	Fluoranthene 5 rings
	%	%	%	%	%
Benzene	1.31	0.62	10.7	5.5	28.6
Toluene	0.83	n.d.	12.1	n.d.	23.8
Dioxane	0.53	0.54	15.1	9.1	37.1
Cyclohexane	0.14	0.025	1.5	0.14	3.5
n-Hexane	0.12	n.d.	1.1	n.d.	2.1
n-Pentane	0.11	0.018	0.8	0.031	1.3
Iso-Propanol	0.06	n.d.	0.5	n.d.	1.3

Although these solubilities are, generally, large enough to ensure that all PAH compounds investigated would be extracted by both alicyclic and aromatic solvents, the solubilities in aliphatic solvents, such an n-pentane and n-hexane, could become critically small for achieving quantitative extractions. Thus, acceptable solvents for the extraction of High-Volume filters would include benzene, toluene, cyclohexane and dioxane.

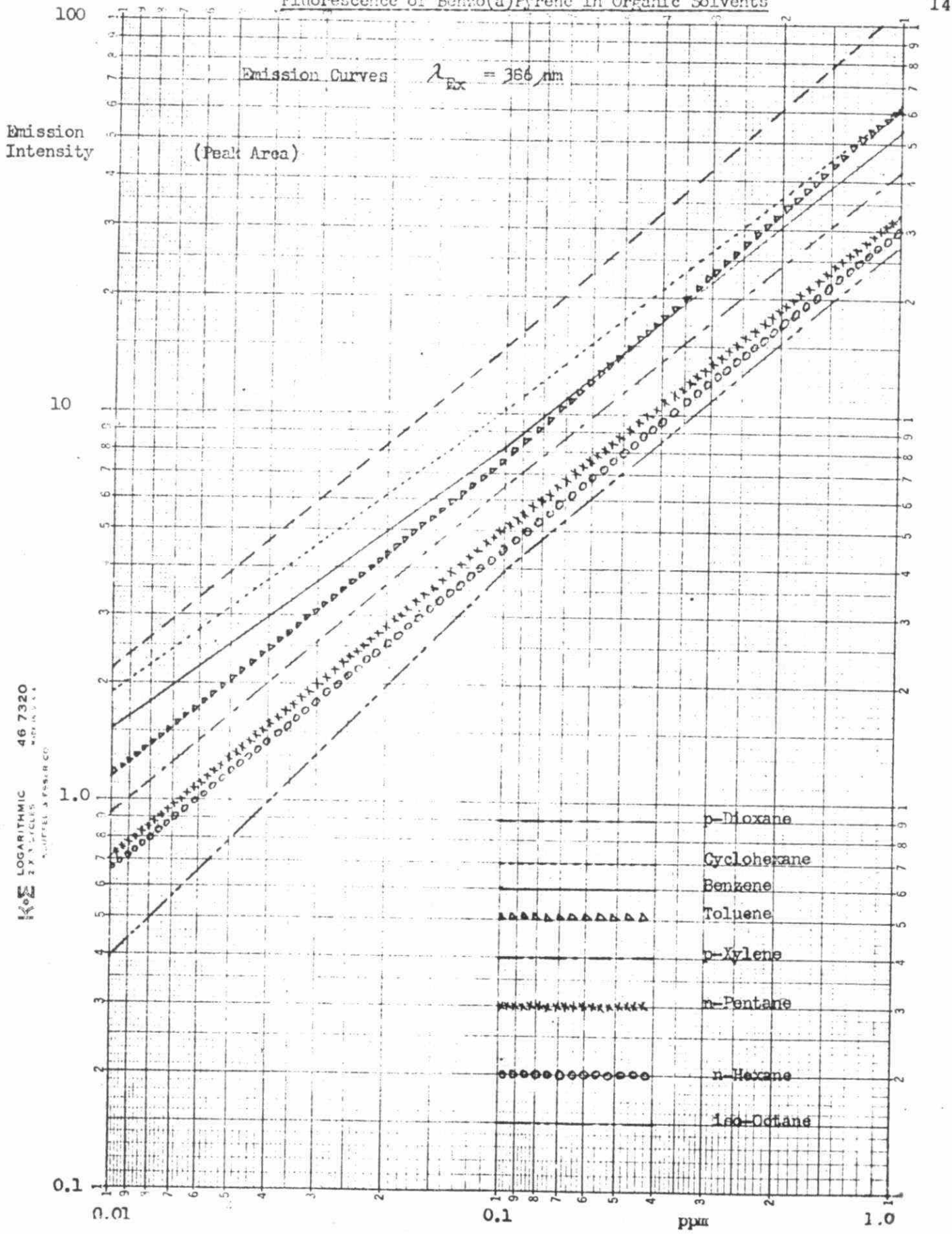
b) The Effects of Solvents on Fluorescence

While studying the absorption characteristics of various PAH compounds, it was observed that the intensities seemed to be unaffected by the type of solvent used. By contrast, an investigation of the excitation and emission spectra of these compounds showed that the intensity of the fluorescence varied significantly with the nature of the solvent.

The change in emission intensity of BaP at 410nm was established over the concentration range of 0.01 to 1.0 ppm for several organic solvents. The results shown in Figure 1 indicate that the intensity of BaP was 2 - 7 times stronger by using aromatic or other cyclic solvents than when aliphatic solvents were used. Thus, considerable advantage could be derived in fluorometric analysis by selecting a solvent which enhances the instrument response and thereby increases the

Figure I

Fluorescence of Benzo(a)Pyrene in Organic Solvents



sensitivity of the analytical method. Such solvents include cyclohexane, benzene, toluene and dioxane, which also have shown relatively high dissolving power for PAH compounds.

c) Soxhlet Extractions of High-Volume Filters

After having established the solubilities of some polynuclear hydrocarbon compounds in a variety of organic solvents and then the effect of these solvents on the fluorescence of such compounds, the efficiency of these solvents for actual High-Volume filter extractions was investigated.

i) Extracted Organic Matter ("Organics")

Soxhlet extractions with six different solvents were made using a composite sample of High-Volume filters originating from Malton, Station #4, as shown in Table 2. After extraction at rapid reflux for a period of 12 hours, aliquots of the extracts were used to establish the weights of extracted material after solvent evaporation.

TABLE 2

COMPOSITE HIGH-VOLUME FILTER, MALTON STATION # 4

Filter Date	Number	Dust Load mg	Air Volume m^3
3/1/1969	3500407	106.3	2124
19/1/1969	3500409	73.8	2172
4/2/1969	3500411	70.8	2196
20/2/1969	3500413	325.9	2154
8/3/1969	3500415	172.8	2100
31/3/1969	3500417	157.5	2020
Composite Filter (average)		151.1	2128

From the weights of the extraction residues, the composite High-Volume filter was estimated to contain about 6.0 mg "organics", which corresponds to 4% by weight of "organics" in the dust and about 3 mg per 1000 m^3 of air. The extraction efficiencies of the various solvents used are shown in Table 3.

TABLE 3

SOXHLET EXTRACTIONS OF COMPOSITE HIGH-VOLUME FILTER

Solvent	Boiling Point °C	Residue (dried at 25° C/80mm for 60 hrs) mg	Residue (dried at 80°C for 1 hr add'l) mg	"Organics" calc'd in 1000 m^3 air mg
n-Pentane	36	0.1	0.1	0.6
Iso-Octane	99	0.3	0.3	1.8
Cyclohexane	81	0.5	0.5	3.0
Benzene	80	0.6	0.5	3.0
Dioxane	101	35.9 *	2.5 *	n.d.
Toluene	111	0.7	0.3	1.8

* The dioxane extract was believed to have given a misleading high result of "organics" owing probably to the considerable water absorption on exposure to the atmosphere while the aliquot samples were taken. Difficulties were also encountered with n-pentane owing to its low boiling point of 36°C and the necessity of replacing evaporation losses.

From Table 3 it is apparent that the highest values for extracted "organics" were obtained with benzene and cyclohexane as the extractants. Therefore, these two solvents were judged to be superior to the other extractants tested in these experiments.

ii) Rate of Extraction

In order to establish the time required and the efficiency of various solvents for the extraction of PAH from High-Volume filters, the rates of extraction were determined. For this purpose, 3ml aliquot samples were taken at various time intervals during the Soxhlet extractions of the filter composite. In each extraction, the size of the filter composite corresponded to exactly half of a filter. The amount of organic solvent used initially in each extraction was 80 ml. The total extraction time was about 12 hours with an estimated 42 Soxhlet cycles occurring during this period.

Fluorescence measurements were made on the extracts at the maximum excitation and emission wavelength (λEx=384, λEm=425 nm). In accordance with results obtained earlier for the total "organics" in the extracts, the highest fluorescence intensities were found for the benzene and cyclohexane extracts while the extracts with the aliphatic solvents showed much weaker intensities, Table 4 and Figure 2.

Although dioxane was initially the "fastest" extractant, its extraction rate decreased finally to the point where actually a loss of extracted material seemed to have taken place. This might be explained by the wide range of materials extracted with dioxane, which includes also metallic and inorganic compounds. These, in the presence of absorbed

TABLE 4

Summary of Results from Soxhlet Extraction of Composite High-Volume Filter with Various Organic Solvents (i)

"Organics" Extracted (mg/1000 m^3 air)	Polycyclics Extracted (Fluorescence, arb. u.)	BaP -Solubility (see Table 1)	BaP Extracted (ug/1000 m^3 air)	Extract Colour
Benzene (3.0)	Benzene (285)	Benzene	Benzene (0.33)	Benzene
Cyclohexane (3.0)	Cyclohexane (267)	Toluene	Cyclohexane (0.33)	Toluene
Toluene (1.8)	Toluene (126)	Cyclohexane	Toluene (0.30)	Cyclohexane
Iso-Octane (1.8)	Pentane (113)	n-Hexane	Iso-Octane (0.28)	Dioxane
n-Pentane (0.6)	Iso-Octane (62)	n-Pentane	n-Pentane (0.20)	Iso-Octane
(ii)	(ii)	(ii)	Dioxane (0.14)	n-Pentane

Increasing Solubility ↑

Clear → Yellow

Increasing Intensity ↑

(i) Sample size: ½ High-Volume Filter; Amount of solvent: 80 ml

(ii) For dioxane see footnote of Table 3.

Efficiency of Air Sample Extractions

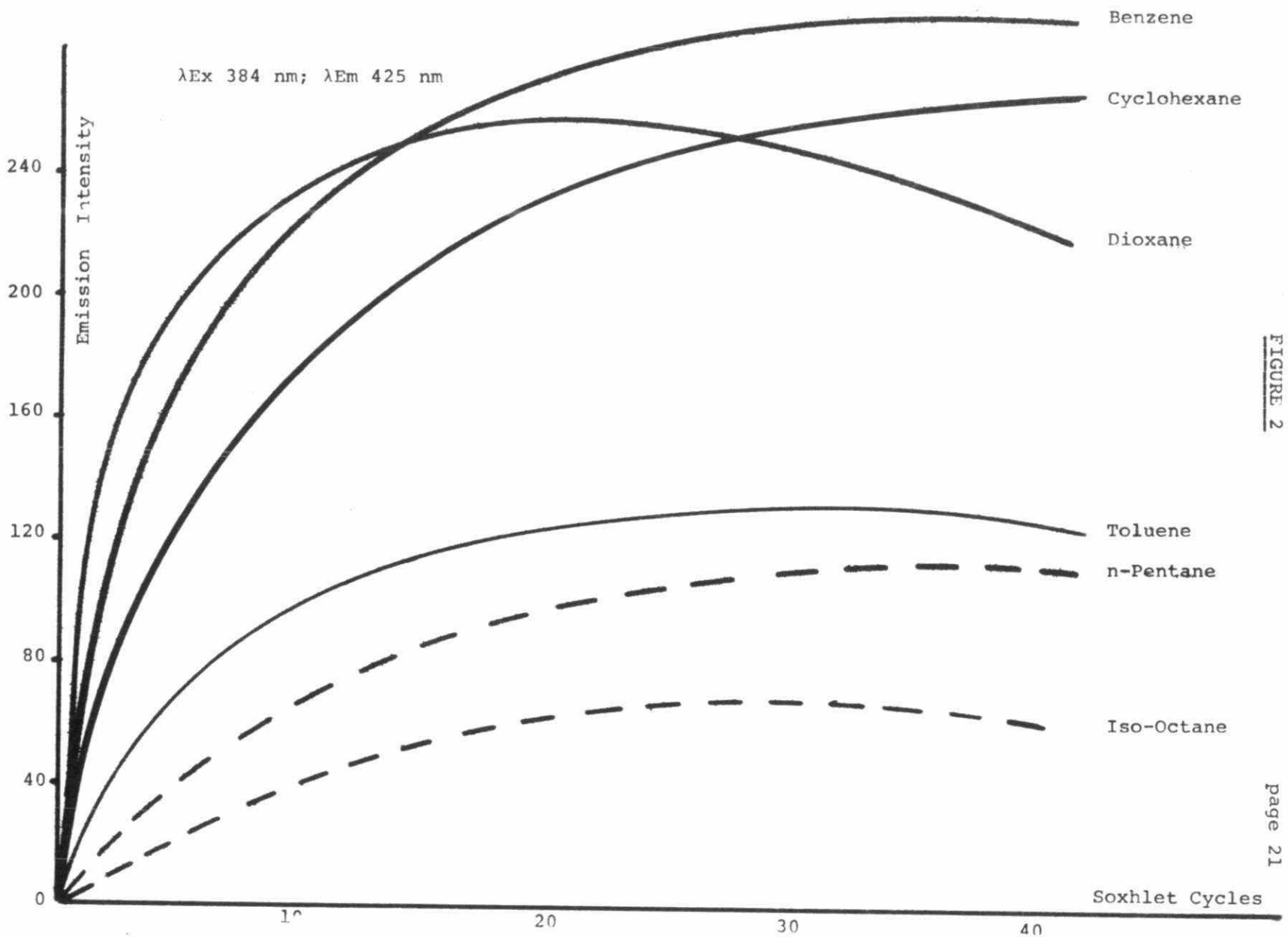


FIGURE 2

water and oxygen from the atmosphere could have given rise to reactions with PAH compounds; these secondary reactions at the relatively high temperature of boiling dioxane could have led to the formation of oxygenated and other organic compounds and thus, to a loss in fluorescence.

The rates of extraction (Figure 2) and the fluorescence of the final extracts (Table 4) show clearly the superiority of benzene and cyclohexane over the other solvents in the Soxhlet extractions of PAH from High-Volume filters. The extraction rate curves indicate that for achieving quantitative extraction, times of 10 to 12 hours would be desirable. We suggest that the extraction period should be maintained over approximately 40-45 Soxhlet cycles to ensure quantitative extraction.

iii) Benzo(a)Pyrene in Soxhlet Extracts

The amount of benzo(a)pyrene extracted from the composite High-Volume filter with various solvents was determined by fluorometry after chromatographic separation of BaP from the other components of the extracts. The procedure used is outlined later in this report. As shown in Table 5, the amounts of BaP found were greatest using benzene and cyclohexane as the extractants. Toluene gave slightly lower values, but the aliphatic solvents and dioxane proved to be much poorer extractants for BaP. The poor performance of dioxane as an extractant seemed to confirm that BaP underwent secondary reactions

TABLE 5

Benzo(a)Pyrene in Composite High-Volume Filter

Extractant	Number of Runs[1]	Average BaP/1000 m^3 Air μg[2]
Cyclohexane	4	0.33
Benzene	6	0.33
Toluene	5	0.30
Iso-Octane	3	0.28
n-Pentane[3]	2	0.20
p-Dioxane[4]	2	0.14

(1) Independent chromatographic separations and fluorometric determinations.

(2) Uncorrected for possible benzo(k)fluoranthene interference.

(3) The low boiling point of n-pentane (36°C) contributed to the inefficiency of this solvent in the Soxhlet extraction.

(4) Water absorption from the air and co-extraction of inorganic components are believed to have resulted in reactions leading to a chemical change of some polynuclear hydrocarbons during the extraction.

during the extraction with this solvent, as mentioned above.

The observation that benzene and cyclohexane were the best extractants was in line with the practice of U.S. workers to use benzene and of Canadian workers to use cyclohexane as the preferred solvent. Accordingly, it was decided to use cyclohexane for all High-Volume filter extractions in the analyses reported in the present study.

concentrations exceeding BkF by not more than a factor of 2 or the results would become unreliable. However, such high BaP to BkF ratios have been found only on very rare occasions, and in these cases the alternative "Direct Method" (2) can be used to overcome this limitation.

ii) Another source of interference at the wavelengths mentioned could be the presence of an unknown PAH compound in the BaP/BkF fractions. To date, the presence of such a compound has not been established in the column effluents from any air samples collected, nor has any indication of such an occurrence been found in the literature. Interference by fluorescing compounds other than PAH would appear to be even less likely to occur.

iii) Exposure of PAH extracts or solutions to intense light over extended time periods, or to heat during solvent evaporation, is known to result in a decrease in the amounts of BaP and BkF found and, therefore,such exposure should be avoided. Glass vials with Teflon lined screw-caps are recommended for temporarily storing the concentrated solutions of BaP and BkF in the refrigerator in the dark. Unless required for special purposes, such storage should not exceed a period of one week prior to analysis. All glass-ware used must be scrupulously clean, including the quartz cells used in the spectrophotofluorometer.

iv) In order to avoid contamination from extraneous material, it is important that the High-Volume filters used in air sampling be free of extractable organic material which might fluoresce at the excitation wavelengths used. Also, the organic solvents used as extraction and as chromatographic developing agents must be free of such interfering materials.

The exposed High-Volume filters should be kept in protective envelopes and stored in a dry and cool atmosphere. No significant loss of BaP or BkF is expected even after several months of storage in this manner. However, after solvent extraction of the filter sample, the steps of chromatographic separation, sample concentration and fluorometric determination should be carried out with as little time delay as possible. Overnight storage of extracts, column effluents and sample concentrates should be done in closed containers under refrigeration and in the dark.

c) Apparatus

i) Soxhlet Extraction Assembly: Flat bottom flasks, 125 ml; Thimbles "Whatman" (free of fluorescence), 25 mm X 80 mm.

ii) Chromatographic Column (glass): 250 mm length, 10 mm I.D.; fitted with a fritted glass stationary support and a Teflon stopcock for effluent control.

iii) Automatic Fraction Collector: Adjustable for time interval and for number of drops; to accommodate two or more chromatographic columns. Fraction tubes, 15 cm x 1.6 cm.

iv) Rotary Evaporator: Round-bottom flasks, 125 ml; water aspirator or vacuum line, hot plate and water bath included as part of the assembly.

v) Spectrophotofluorometer: With x, y-recorder, quartz cells and reference block WG9 (supplied by the Hellman Co. Ltd.)

vi) Graduated Cylinders 5 ml.

vii) Volumetric Flasks, 5 ml, 10 ml, 50 ml.

d) Reagents

i) Cyclohexane, "nanograde" (obtainable from the Mallinckrodt (Canada) Ltd.)

ii) Toluene, "nanograde" (obtainable from the Mallinckrodt (Canada) Ltd.)

iii) Alumina, neutral, 80-200 mesh (obtainable from the Fisher Scientific Co. Ltd.)

iv) Benzo(a)pyrene, for standards (obtainable from the Aldrich Chemical Co. Ltd.)

v) Benzo(k)fluoranthene, for standards (obtainable from the Chemistry Division, Air Pollution Control Directorate, Environmental Protection Service Ottawa.

vi) Activated Carbon, Pittsburgh Type BPL 12 x 30, 15230 for purification and recovery of used toluene, obtainable from the Calgon Corporation, Box 1346, Pittsburgh, Pa.

e) Procedure

I Extraction of High-Volume Filters

i) Cut a 1/10 aliquot of High-Volume filter sample with a standard circular die and transfer into a Soxhlet thimble.

ii) Using 80 ml cyclohexane, proceed with Soxhlet extraction for 10 hours at rapid reflux.

iii) Evaporate the extract to a volume of about 1 ml under reduced pressure with bath temperature of 30 - 50°C.

iv) Transfer the concentrate to a 5 ml graduated cylinder, rinsing the flask with a few drops of cyclohexane for quantitative transfer, then make up to a 3 ml volume with cyclohexane to obtain the extract concentrate. Half of this volume (1.5 ml) is used for the subsequent analysis while the other half serves as a back-up sample as required.

II Preparation of Chromatographic Column

i) Condition the alumina in a drying-oven overnight at 140°C.

ii) Prepare a slurry of about 8 g conditioned alumina with just enough toluene to completely immerse the alumina.

iii) Without delay, pour slurry in portions into the glass column until the settled alumina reaches a height of 140 mm.

iv) Drain the supernatant toluene to a level just above the surface of the alumina by briefly opening the column stopcock. Do not allow the prepared column to run dry.

III Preparation of Standard Solutions

i) Tare a 10 ml volumetric flask.

ii) Weigh 0.0025 g BaP into the flask.

iii) Make up to volume with cyclohexane and mix.

iv) Transfer 40 ul of this solution into another 10 ml volumetric flask using a 50 ul syringe.

v) Make up to volume to obtain a standard BaP solution, containing 1 ppm BaP.

vi) Repeat the 5 preceding steps using BkF, instead of BaP, to obtain a standard BkF solution, containing 1 ppm BkF.

IV Chromatography of Standard Solutions and Filter Extract

i) Apply 50 ul of standard BaP solution onto the alumina column with a 50 ul syringe.

ii) Let the standard solution sink just underneath the alumina surface by briefly opening the column stopcock.

iii) Add toluene with a 5 ml syringe while rinsing the column wall until a ½-inch head appears above the alumina surface, then drain the toluene down to just beneath the alumina surface level.

iv) Add toluene until a 1-inch head appears above the alumina. After connecting the top of the column to a dropping funnel containing toluene, maintain the ½-inch head.

v) After opening the column stopcock, collect a total of 55 fractions of 2.5 ml each at about the rate of 1 fraction per minute.

vi) Repeat the 5 preceding steps with the standard BkF solution.

vii) Repeat Steps ii - v with the sample extract concentrate after quantitatively applying 1.5 ml of the extract concentrate onto the alumina column with a syringe.

V Fluorometric Determination of BaP and BkF

i) Transfer each 2.5 ml fraction into a standard quartz cell and insert into a spectrophotofluorometer.

ii) Measure the emission intensities at 410 nm, using two excitation wavelengths of 384 nm and 308 nm, respectively. Then transfer the 2.5 ml fraction back into the original test-tube.

iii) Combine all fractions of the same run, which show BaP and/or BkF by fluorescence, i.e. fractions 8 to 50, approximately.

iv) Evaporate the combined fractions to about 1 ml under reduced pressure at 30 - 50^{o}C.

v) Transfer the concentrate into a 5 ml graduated cylinder, using a few drops of toluene as a final rinse for quantitative transfer, then make up to a volume of 3 ml with toluene.

vi) Measure emission intensities as in Step ii.

vii) Quenching: If the emission intensities of the sample exceed significantly those of the standard solutions, dilution of the sample by factors of 10, 100, 1000, or whatever required, has to be made. After the sample has attained a comparable fluorescence by such dilution, a corresponding correction must be made in the subsequent calculations.

f) Calculation and Reporting

The analytical results for the combined fractions, are calculated (19) according to the equations shown below and reported as ug/1000 m^3 air.

$$\frac{\text{ug BkF}}{1000\ m^3\ \text{air}} = \frac{\text{Em(Sample)}\lambda\text{Ex 308 nm}}{\text{Em(BkF Std.)}\lambda\text{Ex 308 nm} \times m^3\ \text{air}} \times 1000 \times \text{dil. factor}$$

$$\frac{\text{ug BaP}}{1000\ m^3\ \text{air}} = \frac{\text{Em(Sample)}\lambda\text{Ex 384 nm} - \left(\frac{\text{Em(Sample)}\lambda\text{Ex 308nm}}{\text{Em(BkF Std.)}\lambda\text{Ex 308 nm}} \times \text{Em(BkF Std.)}\lambda\text{Ex 384 nm}\right)}{\text{Em(BaP Std.)}\lambda\text{Ex 384 nm} \times m^3\ \text{air}}$$

$$\times 1000 \times \text{dil. factor}$$

The time period for calculating the results according to these equations can be drastically shortened by using a desk computer with magnetic program cards.

g) Precision and Accuracy

BaP in concentrations of 0.25 ug/ml can be measured within an accuracy of better than 0.002 ug. BkF at 0.25 ug/ml can be measured within an accuracy of better than 0.001 ug. If the concentration of BaP found is more than twice the BkF concentration, the BkF results will be in error by a factor of 10 percent (45).

h) Safety Precautions

i) Use surgical gloves when handling High-Volume filters, BaP and other PAH-reference compounds, toluene or cyclohexane. Avoid inhaling the dust or vapours from these materials.

ii) Toluene and cyclohexane vapours are highly flammable. Do not use near an open flame and have a fire extinguisher available.

3) The "Direct Method" for BaP and BkF Analysis

While the estimation of BaP and BkF by the "Indirect Method" gives close approximations of the concentrations of these compounds in most High-Volume filter extracts, a fast and "direct" method to cover the entire concentration range of BaP and BkF is still desirable. Not only would such a method permit the analysis of all air samples regardless whether BaP is present in large excess over BkF or not, but it could also serve for verifying the accuracy of the "Indirect Method" whenever it is used. The key for such a method would be the efficient and quantitative separation of BaP and BkF not only from other material in the air sample extract but also from one another. Only then can these two compounds be determined directly and independently.

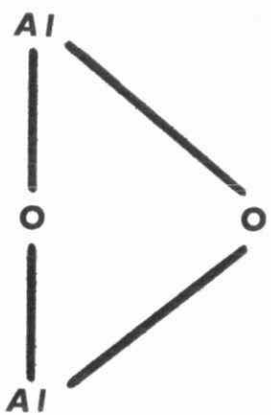
Alumina has been used for a long time as an effective chromatographic adsorbent for the purpose of separating polynuclear hydrocarbon compounds. A special high-efficiency alumina, "Peter Spence H-type", had been the adsorbent by which the chromatographic separation of BaP and BkF from interfering PAH compounds could be achieved (19) in the "Indirect Method". No chromatographic method or adsorbent was known by which BaP and BkF could be separated from each other in a simple one-step procedure. With the aim of developing such a procedure in this work, conditions were finally established which enabled a separation and which permitted direct fluorometric determination of BaP and BkF in air samples.

While investigating surface properties and activation potentials of a number of commercial aluminas, one specific type of "micro-neutral" alumina was found to possess differences in adsorption towards BaP and BkF, from which conditions for separating these compounds could be developed. This alumina, with the trade name "WOELM-Grade 101", has a Brockman activity 1 and a pH-value 7.5. In contrast to other commercially available neutral aluminas, which are mixtures of acid and basic grades, this type is unique in its "micro-neutrality", i.e. neutrality at each active site. With the surface functionality of an adsorbent being based on the molecular structure at the surface, the acidic or basic group present on alumina can catalyse reactions (dimerization, isomerization, etc.), change the character of the materials being separated, or remain inactive as an adsorbent (Figure 3). In micro-neutral alumina each particle is itself neutral on a molecular basis, which assures micro-uniformity and optimum chromatographic efficiency.

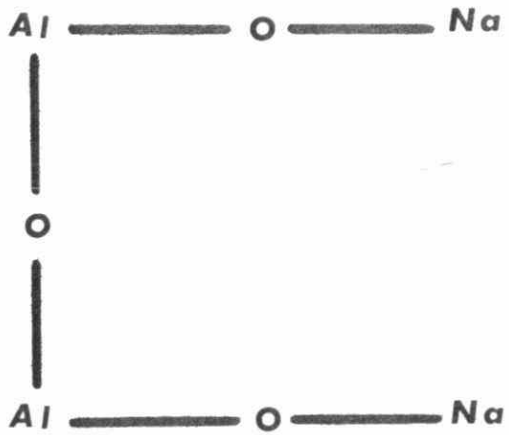
For achieving satisfactory retention times for BaP and BkF on the Woelm alumina, the required degree of deactivation is attained by conditioning for 90 minutes in a chamber with 60% humidity at room temperature. A saturated aqueous solution of magnesium nitrate can be used for maintaining this humidity level. The alumina which has absorbed 1.3% additional water is

Molecular Structures at Alumina Surface

Acidic



Neutral



Basic

FIGURE 3

used immediately for making up a slurry with toluene, with which the chromatographic column is prepared. The conditions for the subsequent chromatographic separation procedure, for which an automatic fraction collector is highly recommended, are shown in Table 6.

The High-Volume filter extract, representing 1/20 of the filter is evaporated under reduced pressure to a volume of about 0.5 ml. This amount is applied quantitatively with a syringe onto the surface of the alumina which is never allowed to run dry of the eluent. During the chromatographic separation in which a total of about 120 fractions is taken, the fractions are fluorometrically tested for their BaP or BkF contents. Measurements for those two compounds are made at λ Ex=308 and 384 nm; λ Em=410 nm; and are compared with reference standards as described for the "Indirect Method".

After combining all BaP containing fractions in one volume and those containing BkF in another, each solution is evaporated in vacuo to a volume of 3 ml. The amounts of BaP and BkF in these solutions can now be determined directly with a fluorometer by relating the emission intensities to those of known standards. Figures 4 and 5 give an illustration of the chromatographic separation achieved from a synthetic mixture of BaP and BkF, in comparison with unseparated BaP and BkF by the "Indirect Method". Similar results can be obtained from

TABLE 6

"DIRECT METHOD"

CONDITIONS FOR LIQUID PHASE CHROMATOGRAPHY

Sample Size for Extraction	: 1/10 of High-Volume Filter
Portion for Analysis	: 1/20 of High-Volume Filter (½ of extract)
Adsorbent	: WOELM 101 Alumina (micro-neutrality) Brockman Activity 1 + 1.3% H_2O
Eluent	: Toluene ("nanograde", Mallinckrodt)
Column	: Length 100 mm; Diameter 11 mm.
Total Fractions	: 120, approx.
Fraction Size	: 2.5 ml
Flow Rate	: 1 Fraction/Minute
Analyzed for BaP (λEx=384 nm)	: 20th - 54th Fraction
Analyzed for BkF (λEx=308 nm)	: 55th - 120th Fraction
Total Time Required	: 2 Hours

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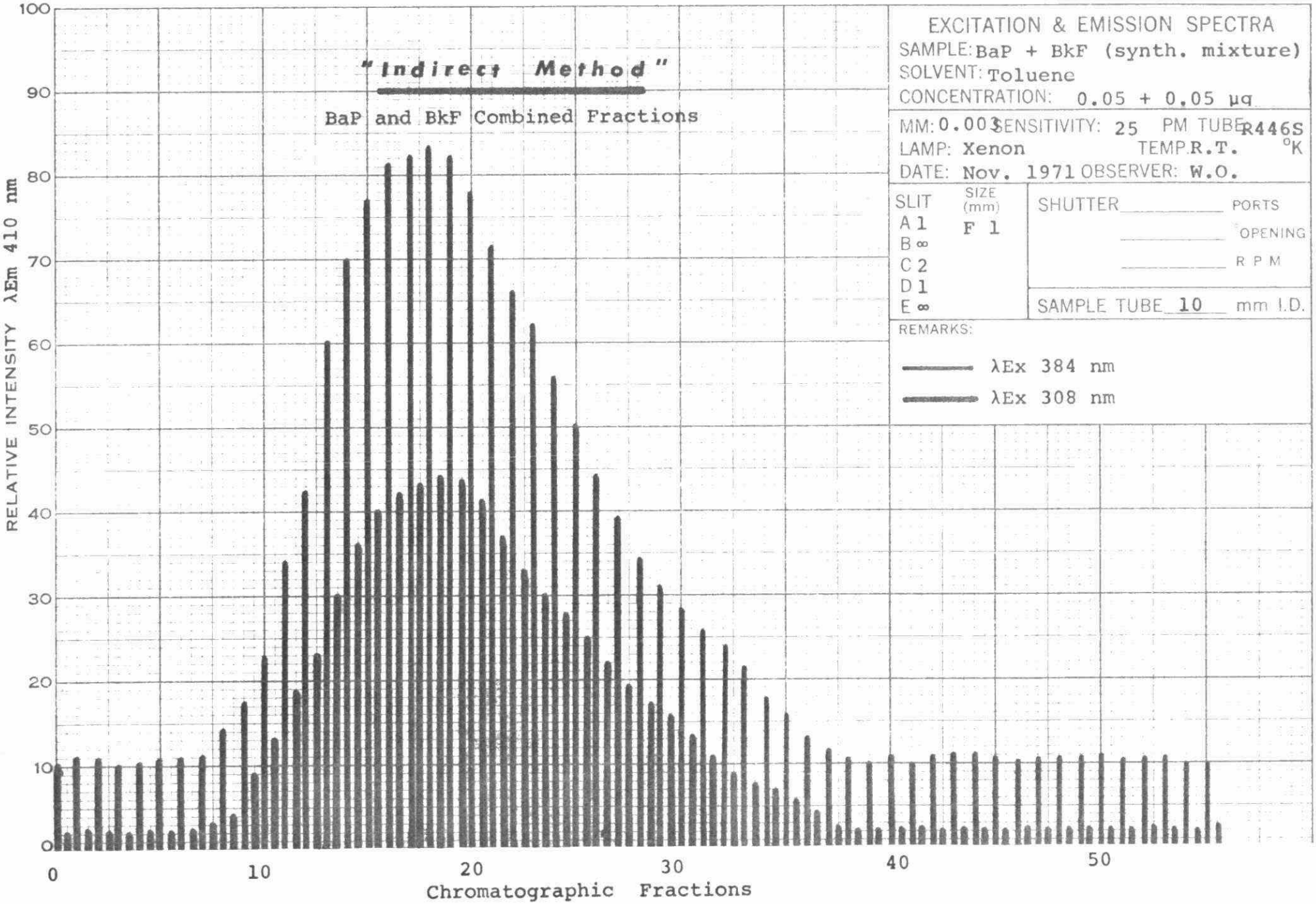

FIGURE 4

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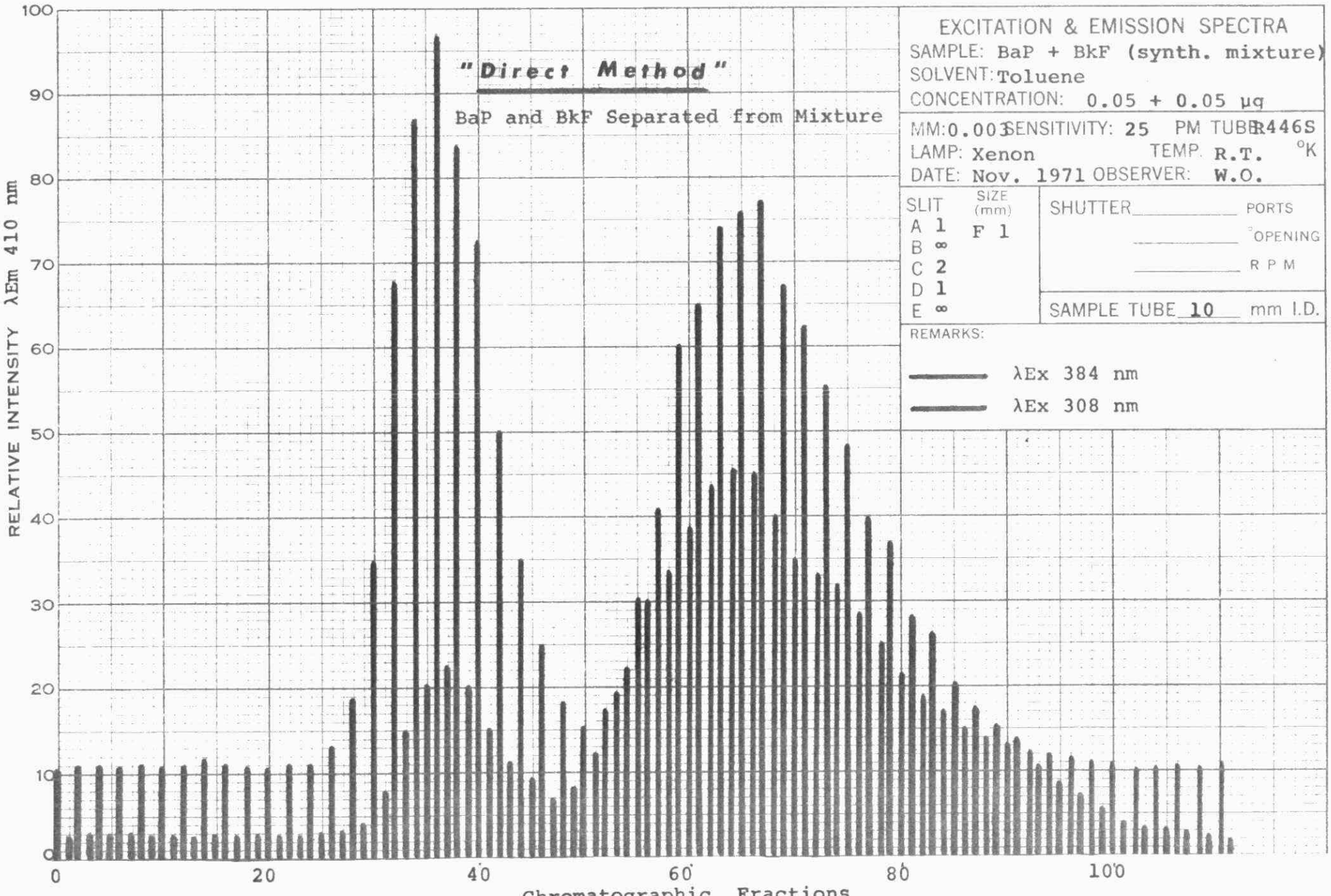

FIGURE 5

actual High-Volume filter extracts. Separated from other polynuclear hydrocarbons, BaP and BkF remained unseparated under the conditions of the "Indirect Method" (Figure 6), while good separation was achieved under the conditions of the "Direct Method" (Figure 7).

For the purpose of establishing the applicability of the "Direct Method" versus the "Indirect Method", known mixtures of BaP and BkF were analyzed by both methods. In order to cover a wide range of concentration ratios, mixtures containing up to 20 times the amount of one compound over the other were analyzed. The results shown in Figure 8 demonstrate that both the "Direct" and "Indirect Methods" are equally applicable at BkF concentrations equal to or higher than those of BaP.

With BaP concentrations higher than those of BkF, however, the values for both BaP and BkF became progressively less reliable when the "Indirect Method" is used, while correct values are obtained by the "Direct Method" (Figure 9). Our present survey of BaP and BkF in urban atmospheres in Ontario has shown that of 165 air samples analyzed over a five-month period, only ten, or 6%, had substantially higher BaP than BkF concentrations. Only in these relatively few cases was the use of the "Direct Method" indicated, while the somewhat faster "Indirect Method" could be applied in all others (Table 7).

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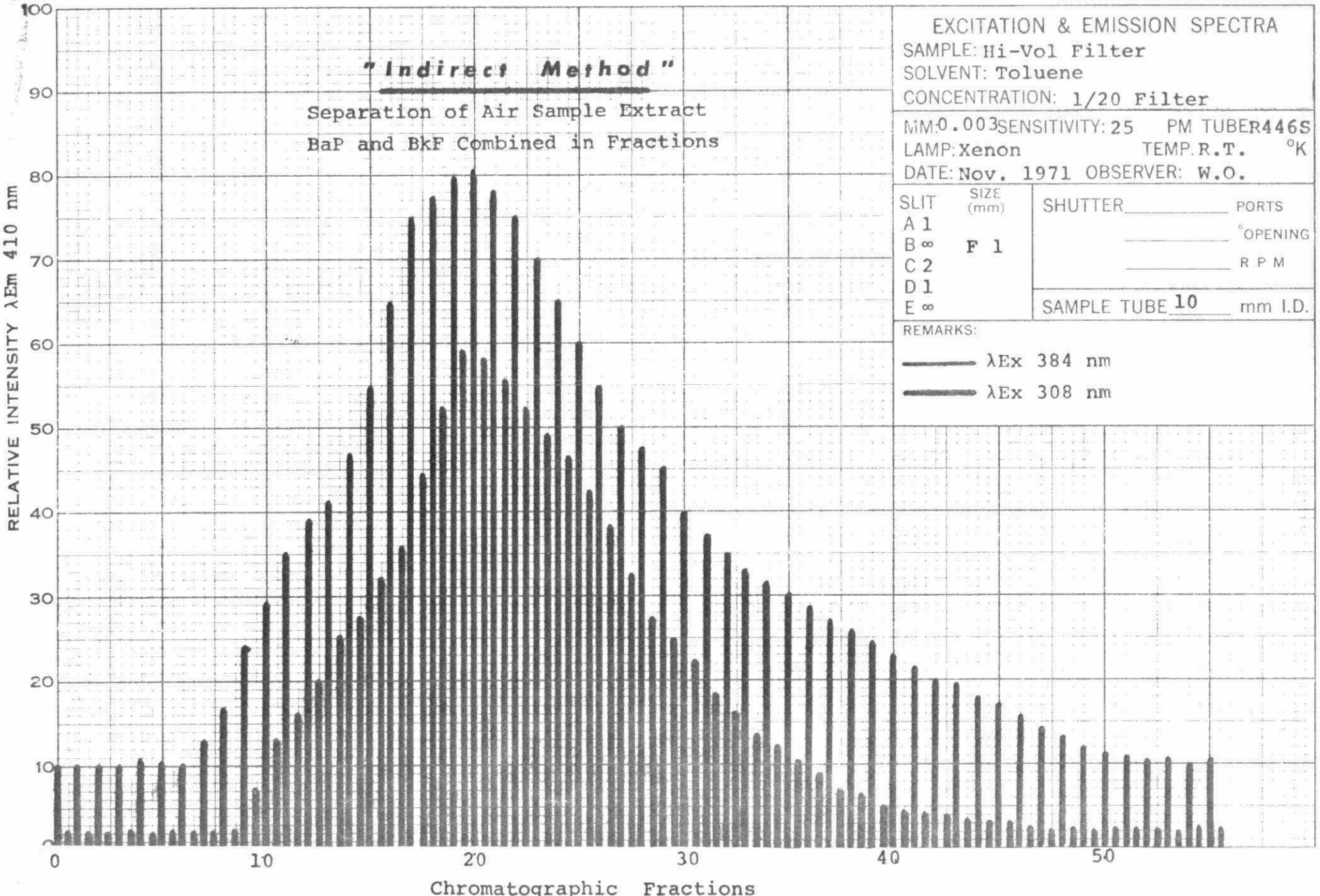

FIGURE 6

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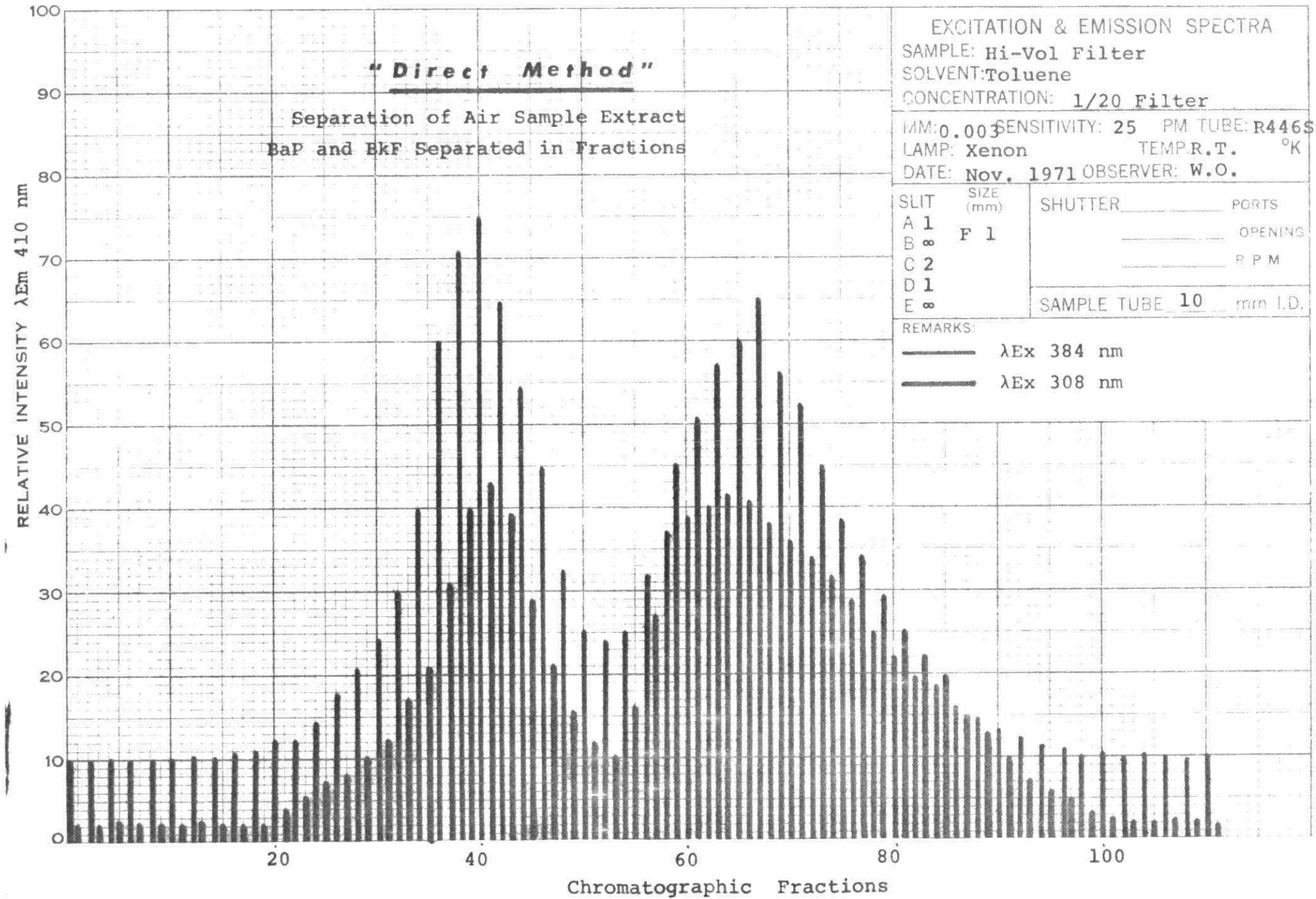
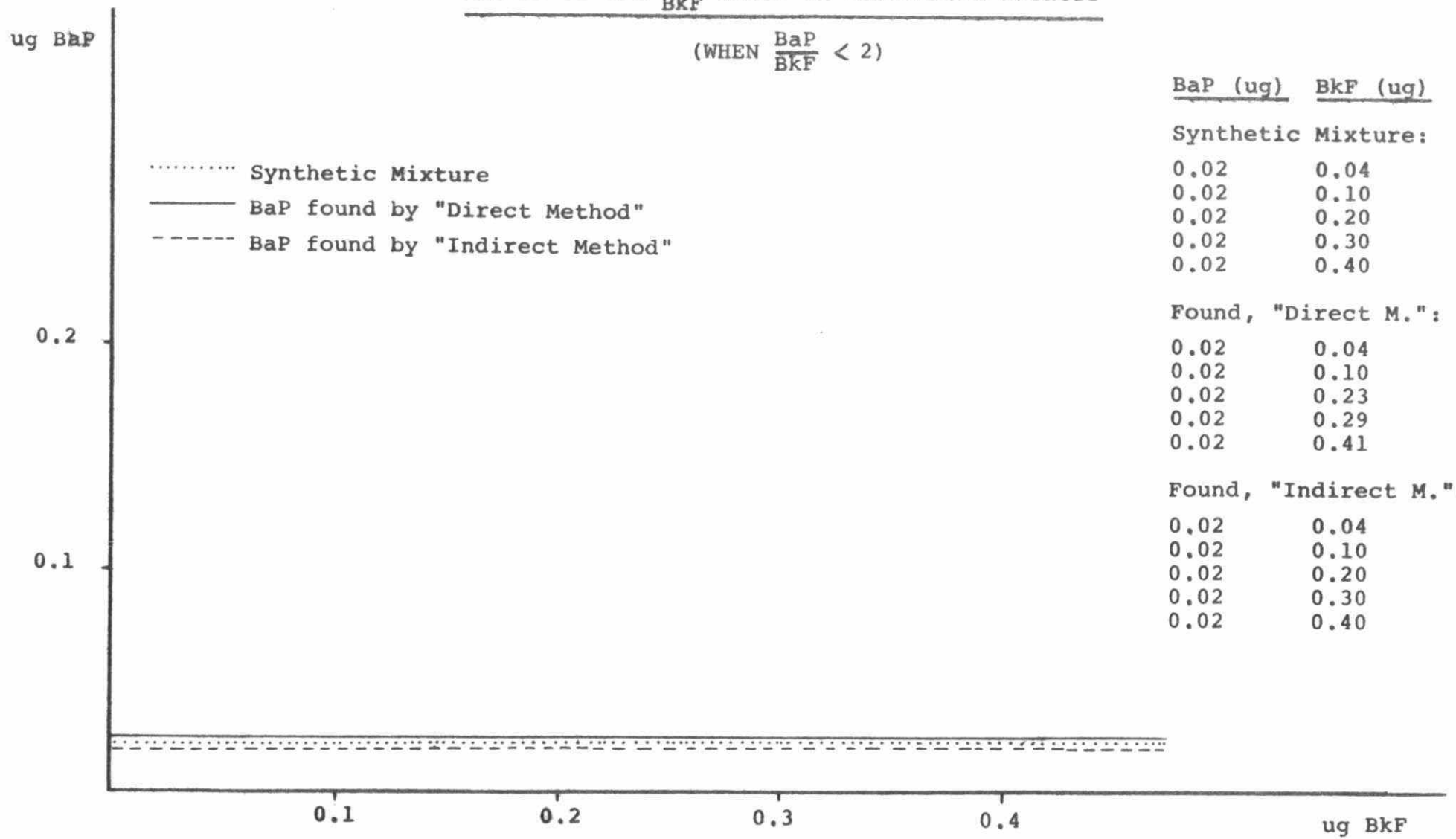


FIGURE 7

EFFECT OF THE $\frac{BaP}{BkF}$ RATIO ON ANALYTICAL METHODS

(WHEN $\frac{BaP}{BkF} < 2$)

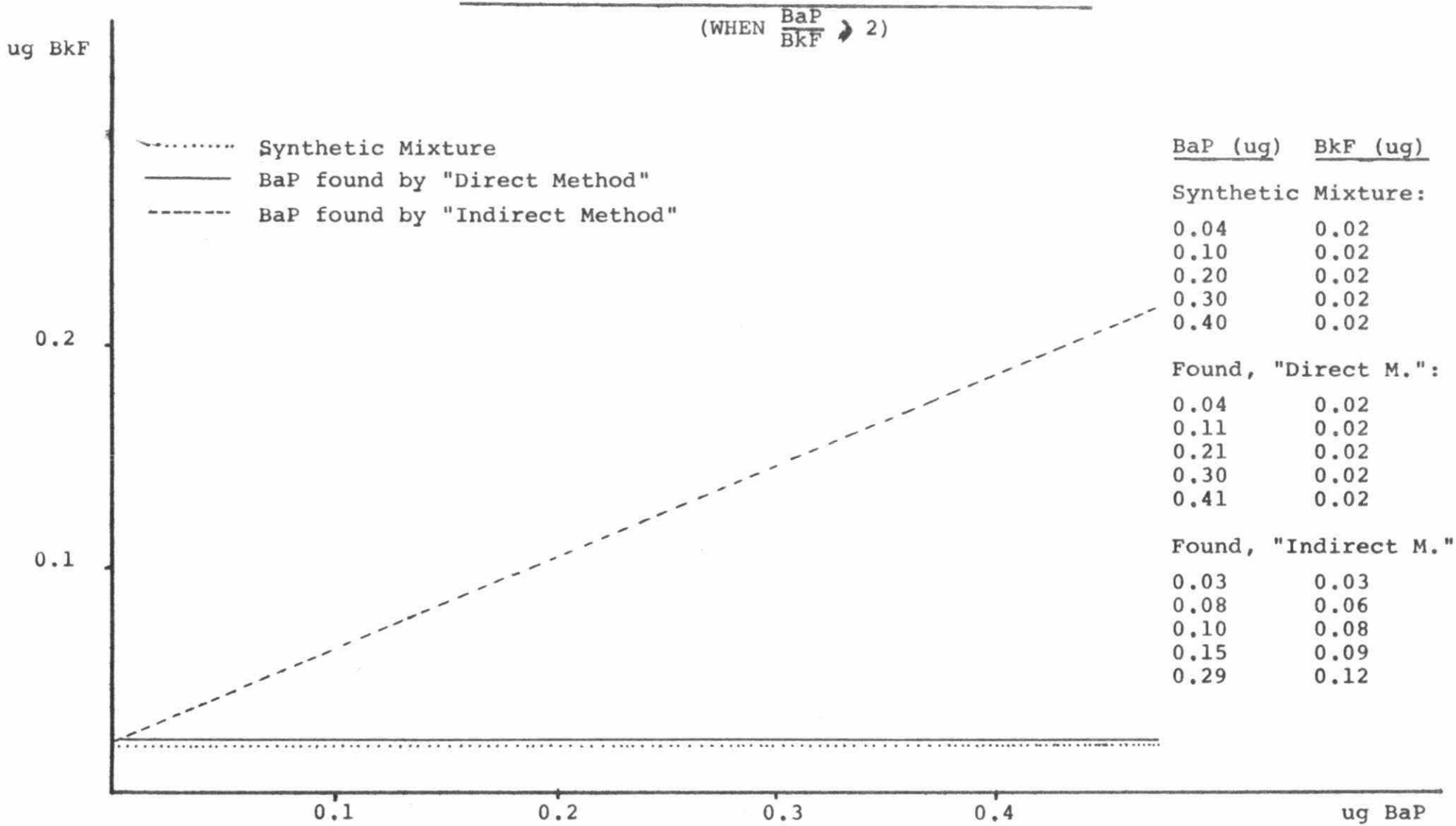


BaP (ug)	BkF (ug)
Synthetic Mixture:	
0.02	0.04
0.02	0.10
0.02	0.20
0.02	0.30
0.02	0.40
Found, "Direct M.":	
0.02	0.04
0.02	0.10
0.02	0.23
0.02	0.29
0.02	0.41
Found, "Indirect M.":	
0.02	0.04
0.02	0.10
0.02	0.20
0.02	0.30
0.02	0.40

FIGURE 8

EFFECT OF THE $\frac{BaP}{BkF}$ RATIO ON ANALYTICAL METHODS

(WHEN $\frac{BaP}{BkF} \geq 2$)



BaP (ug)	BkF (ug)
Synthetic Mixture:	
0.04	0.02
0.10	0.02
0.20	0.02
0.30	0.02
0.40	0.02
Found, "Direct M.":	
0.04	0.02
0.11	0.02
0.21	0.02
0.30	0.02
0.41	0.02
Found, "Indirect M.":	
0.03	0.03
0.08	0.06
0.10	0.08
0.15	0.09
0.29	0.12

FIGURE 9

The longer time (by about 1 hour) required for the "Direct Method" can at least partly be compensated by conversion from single cell measurement to continuous (fluorometric)measurement. The chromatographic column effluent can be scanned directly and on a continuous basis by use of a quartz flow-through cell inserted into the spectrophotofluorometer. The BaP and BkF concentrations can readily be established by integration of the peak areas. An example of the recording obtained by continuous operations is given in Figure 10. From such operations, simplification of the method, optimization of fluorometer use and savings in manual labour can be realized. However, it is pointed out that the successful application of the "Direct Method" is critically dependent on the clean separation of BaP from BkF in the chromatographic column.

TABLE 7

COMPARISON OF METHODS

Air Samples with High BaP/BkF Ratios

Sample	"Indirect Method"		"Direct Method"	
	BaP*)	BkF*)	BaP*)	BkF*)
33002-18-12	1.59	0.36	1.03	0.59
31001-18-12	0.37	0.18	0.35	0.25
12008-03-12	12.85	7.00	10.90	10.70
12008-02-01	8.23	4.24	6.73	5.71
29008-18-12	0.82	0.37	0.82	0.66
51001-31-10	0.24	0.21	0.75	0.51
75020-18-12	0.33	0.20	0.44	0.30
75020-03-01	0.71	0.35	0.96	0.63
33002-11-01	0.45	0.37	0.65	0.47
33002-24-04	0.67	0.49	0.88	0.65

* ug/1000 m^3 Air

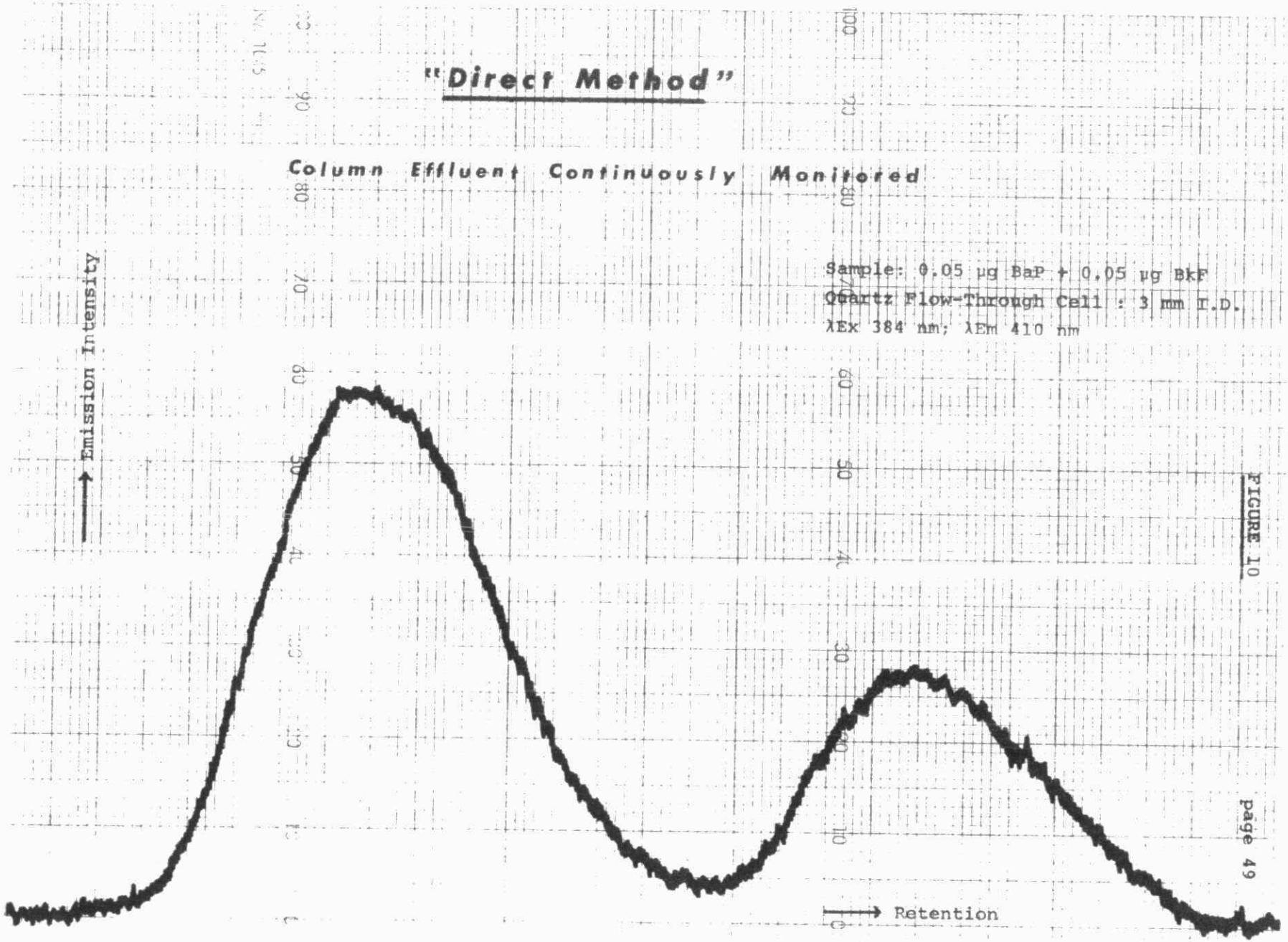

"Direct Method"
Column Effluent Continuously Monitored
Sample: 0.05 µg BaP + 0.05 µg BkF
Quartz Flow-Through Cell : 3 mm I.D.
λEx 384 nm; λEm 410 nm
Emission Intensity
Retention

FIGURE 10

SURVEY OF BaP and BkF

1) Extent of Survey

In previous reports (3,4), we have shown results from the first year of our survey of BaP and BkF in the air of up to eleven urban communities in Ontario. We now have extended the time period of the survey by a second year and have thus completed two years of survey covering the eleven communities over the time period July 1971 to July 1973. The communities investigated in this survey had been selected in consultation with Dr. M. Fitch, Medical Consultant, Occupational Health Protection Branch, Ontario Ministry of Health, and Mr. D.A. Thomas, Air Resources Branch, Ontario Ministry of the Environment. High-Volume filters from all sites were analyzed on a bi-weekly basis with the exception of those from Welland, which were run on a weekly basis. The eleven communities surveyed, together with reasons for their selection are shown in Table 8.

With the aim of providing sufficient background information for obtaining a better understanding of the effects of environmental factors and variables on the BaP and BkF levels, an investigation of relevant topographical and meteorological conditions was included in this survey. After establishing changes and variations in these conditions for each community and plotting them together with the corresponding BaP and BkF levels, correlations of these levels with the environmental conditions became apparent. The resulting correlations found are briefly outlined and discussed in the following chapters.

TABLE 8

Stations of High-Volume Filters Used in Survey

Location	Station #	Reason for Selection
Hamilton (North Park Ave.)	29008	Heavy Industry (Steel, Carbon Black)
Windsor (University Ave.)	12008	Neighbouring Detroit's Industry
Welland (St. Peter & Paul School)	27027	Heavy Industry (Steel, Carbon Black)
Cornwall (Post Office Bldg.)	56066*	Industry (Pulp & Paper)
Cornwall (Memorial Park)	56051	Industry (Pulp & Paper)
Sarnia (Front & Lochiel)	14051	Petrochemical Industry
Toronto (College Street)	31001	Ambient Mid-City Air (6'th Floor)
Toronto (Highway 401-Pharmacy)	33002	Heavy Traffic (Ground Level)
Ottawa (McDonald Gardens)	51001	Capital (Business and Residential)
North Bay (Teachers' College)	75020	"Background Levels"
Sudbury (Ash Street Tank)	77016	Large Smelters
Sault Ste. Marie (Ontario Bldg.)	71021	Steel Mills

* Operation of Station discontinued in November 1971

The results of the two-year survey of BaP and BkF in the air of the eleven urban communities are summarized in Tables 38-A to 48-D. In the Tables, the amounts of the polynuclear aromatic hydrocarbons are shown per volume of air as well as per weight of dust (air particulates). For better visual perception, the variations in concentration levels are graphically shown in Figures 19-A to 29-B. For each community the results are plotted on two graphs, one for each full calendar year, which permits direct comparison of the pollution levels of the first with those of the second year.

In addition, a number of influencing factors and environmental variables were obtained and included in the Tables and Figures for the purposes of correlating them with the concentrations found for these pollutants. Thus, by considering the pollution sources which might be responsible for the pollutant levels, the type of the urban community was established and the dates (season, month, day of the week) were recorded when the air samples were taken. Meteorological data, such as average wind direction and wind speed, periods of temperature inversion and coefficient of haze were obtained for purposes of correlating them with the pollutant levels observed. The concentration of total suspended air particulate matter (dust) and optical densities of the High-Volume filter solvent extracts were recorded for the same purpose.

a) Station Location and PAH Level

The eleven urban communities investigated in this survey showed differences in their pollutant levels which could be linked to the presence and types of pollution sources in their vicinities. Based on these pollution sources and the levels of BaP and BkF observed, the communities could be grouped into the following classes:

- Industrial (High levels): Welland, Windsor, Hamilton
- Industrial (More moderate levels): Cornwall, Sault Ste. Marie
- Residential and Business: North Bay, Ottawa, Toronto (College Street)
- City Traffic: Toronto (Highway 401-Pharmacy at street level)
- Petrochemical: Sarnia
- Ore-processing (Smelters): Sudbury

Under the following sub-headings the various classes of urban communities and Station locations are discussed and reference should be made to Figures 11 to 16 and to Tables 9 to 19 ("Summary of Annual Results") for easy comparison of BaP and BkF concentration levels. The results for all communities investigated are shown on the basis of maximum, minimum and average pollutant levels for the first and second year and for the combined two-year period of this survey.

i) Industrial

By far the highest pollution figures in this survey were found for the heavy-industrial communities of Welland,

Windsor (nearness to Detroit) and Hamilton, with BaP and BkF levels ranging generally 5 to 100 times higher than in the "Residential and Business" communities. The levels in Welland exceeded by far those of all other communities investigated and ranged upwards to 116 ug BaP and 176 ug BkF per $1000m^3$ air. Compared with average pollutant levels in Ottawa, for example, these levels were about 350 times higher. The main pollution source at Welland appeared to be the Union Carbide Company with its graphite electrode production to supply its large electrolytic smelters and possibly Mansfield-Denman General Ltd., users of carbon-black for rubber compounding. The Atlas Steel Company is also located in Welland.

The two-year survey in Welland was carried out from December 1971 to December 1973; all other communities were surveyed between the corresponding July dates, as already mentioned. In Welland the maximum levels of BaP and BkF were found to be lower in the second year than in the first, while little or no changes occurred in the average levels over the two-year period (Table 9). It also became evident that the BkF levels in Welland exceeded the BaP levels by about 3 to 4 times, while in all other communities investigated the levels of these two pollutants were found to be much closer to each other. Since BkF is usually considered to be a measure for the presence of other PAH compounds, including carcinogenic compounds other than BaP, it can be assumed that the atmosphere in Welland also contained such compounds whenever the BkF levels were found to be high.

The dust (or total suspended particulate) levels also reached a record value in Welland at 1717 $\mu g/m^3$ air, when compared with any other community investigated. For example, the average dust level in Ottawa was 78 $\mu g/m^3$ air over the two-year period. As for all communities investigated, BaP and BkF pollution was also expressed in this survey in µg per gram of dust. The corresponding pollutant levels in Welland reached values as high as 843 and 2128 ug/g dust. Obviously, at lower dust levels, the corresponding BaP and BkF dust values would still be higher.

Because of the high PAH and dust levels found in Welland, the usual sampling frequency of one High-Volume filter every 12 to 14 days was stepped up during November and December 1973 to a 3-day frequency. This two-month period provided, of course, a sharper and more realistic picture of the variations in these pollutant levels, as shown in Figure 19-C.

High pollution levels, up to 35 ug BaP and 73 ug BkF per $1000m^3$ air, were observed at Windsor where Detroit's steel mills and coal-fired power plants to the NW, W and SW appeared to be the main pollution sources. However, the average levels over the two-year period seemed more moderate at 2.2 and 4.1 $ug/1000m^3$ air for BaP and BkF, respectively, evidently on account of changing wind direction throughout the year. By comparing the first year of the survey with the second, virtually no change in the average levels for all three pollutants, BaP,

BkF, and dust was observed in the two year period (Table 10).

Very similar conditions to those in Windsor prevailed in Hamilton at the Station near the Burlington Skyway facing the harbour and the steel mills complex to the west (Table 11). Frequent high pollutant levels with westerly winds are believed to have originated mainly from these steel companies (Dominion Foundries and Steel Ltd., and The Steel Company of Canada, Ltd.) and from carbon black manufacture (Columbian Carbon (Canada) Ltd.). Here too, the average BaP, BkF and dust levels were found to be more moderate as a result of changing wind direction. However, all pollutant levels were significantly higher in the second year of the survey than in the first.

In Sault Ste. Marie, however, generally much lower BaP and BkF and dust levels were recorded than in the three communities discussed before, notwithstanding the presence of the Algoma Steel Corporation Ltd. Particularly, in this city the first year of our survey showed only low pollutant levels with BaP and BkF levels never higher than 1.2 and 2.2 ug/1000m^3 air, respectively. During the second year much more significant maxima were reached with 22.5 and 34.0 ug/1000m^3 air for BaP and BkF, respectively, although these high levels seemed to be rather unusual occurances at this Station (Table 12). See also Page 187.

In Cornwall, the bark-burning operation of the local pulp and paper company could have been the source of some polynuclear hydrocarbon emission. Pollution levels in this area were relatively low during the first year but reached moder-

ately high levels of 6.7 and 19.5 ug/1000m^3 air for BaP and BkF, respectively, during the second year of the survey (Table 13).

ii) "Residential and Business"

The residential area of Ottawa (Table 14) and North Bay (Table 15) with little or no significant industry in the neighbourhood, showed average BaP and BkF levels below 0.6 ug/1000m^3 air and maxima of generally less than 1.9 ug/1000m^3 air. Only one outstanding exception for these low levels occurred in North Bay on April 19, 1973 when unexpectedly high levels of 15.6 and 7.35 ug/1000m^3 for BaP and BkF, respectively, were recorded.

In line with generally low pollutant levels in the above non-industrial communities, BaP and BkF levels were similarly low in mid-city Toronto, (College Street) at the 6th floor level where almost ambient air conditions can be expected. The only exceptions were periods during which temperature inversions were known to have occurred, in which case BaP and BkF levels reached about 4 ug/1000m^3 air. In spite of these moderately high peaks, the average levels (including those of inversion periods) were less than 0.75 ug/1000m^3 for both BaP and BkF, at this Station (Table 16). Not too surprisingly, relatively high dust levels, (up to 1019 ug/m^3 air), reaching their peaks during temperature inversion periods, were found at this central location at roof-top level.

iii) "City Traffic"

The effect of heavy motor-car traffic within the city limits of Toronto at Highway 401, at Pharmacy Street, on BaP and BkF levels was found to be unimpressive and hardly noticeable. The values obtained for these levels were less than half at this busy intersection than at the mid-city location (Table 17). Despite minor inversion peaks, the maximum levels remained below 2.25 ug/1000m^3 air with average levels not higher than 0.60 ug/1000m^3 air for these two PAH pollutants. Also, the dust levels at this open highway location remained well below those at the mid-city roof-top location. For both Toronto locations, the three pollutants showed little differences in their levels from the first to the second year of the survey. Results obtained in an additional short-term traffic study in downtown Toronto are given on pages 179 and 180.

iv) "Petrochemical"

Only one location between Sarnia and the petrochemical industry to the south was investigated where the influence of this industry was expected to be felt. Surprisingly, very low levels of BaP and BkF prevailed throughout this survey with the exception of one major peak in May 1973. In spite of this maximum of 4.3 and 5.2 ug/1000m^3 air for BaP and BkF, respectively, the two-year average levels were only 0.3 and 0.4 ug/1000m^3 air (Table 18). Although it now seems unlikely that pollution by these polynuclear hydrocarbons poses a serious problem in the Sarnia area, an investigation of pollution levels at sites closer to and more downwind from the main industries should be considered.

v) "Ore-Processing"

The large smelters of Sudbury (International Nickel Company of Canada, Ltd., and Nickel Mines Ltd.), apparently did not cause even moderate pollution by polynuclear aromatic hydrocarbons. In fact, at the Sudbury Station, BaP and BkF persistently gave the lowest levels of the entire survey. Maximum levels during this two-year period were 0.7 and 0.3 ug/1000m^3 air for these two compounds while average levels were only 0.1 ug/1000m^3 in either case (Table 19). This result may not seem surprising, since the main pollutants from these ore-processing plants are metals and other inorganic materials, such as sulphur dioxide, while carbonaceous organic compounds are virtually absent. It should be noted, however, that the dust levels at this Station were not as high as one may have thought and were rather comparable with those in Sault Ste. Marie.

TABLE 9

Summary of Annual Results: Welland, Sta. 27027

Time Period	First Year 18/12/71 to 26/11/72	Second Year 12/12/72 to 29/12/73	First & Second Year 18/12/71 to 29/12/73
BaP, ug/1000m^3 Air			
Max.	116	54.8	116
Min.	0.24	0.06	0.06
Average	8.07	5.07	5.98
BkF, ug/1000m^3 Air			
Max.	176	138	176
Min.	0.43	0.66	0.43
Average	19.8	19.46	19.57
Dust, ug/m^3 Air			
Max.	798.6	1716.8	1716.8
Min.	60.6	30.1	30.1
Average	243.4	228.9	233.3
BaP, ug/g Dust			
Max.	843	446	843
Min.	1.11	0.12	0.12
Average	53.2	36.16	41.35
BkF, ug/g Dust			
Max.	2128	1384	2128
Min.	3.68	4.52	3.68
Average	145.9	152.95	150.81
Number of Filters (N)	32	73	105

TABLE 10

Summary of Annual Results: Windsor, Sta. 12008

Time Period	First Year 6/7/71 to 11/7/72	Second Year 29/7/72 to 18/7/73	First & Second Year 6/7/71 to 18/7/73
BaP, ug/1000m^3 Air			
Max.	14.9	35.4	35.4
Min.	0.07	0.05	0.05
Average	2.02	2.37	2.19
BkF, ug/1000m^3 Air			
Max.	73.4	41.2	73.4
Min.	0.25	0.12	0.12
Average	4.00	3.32	4.14
Dust, ug/m^3 Air			
Max.	328.4	278.3	328.4
Min.	70.0	68.9	68.9
Average	155.7	127.8	142.3
BaP, ug/g Dust			
Max.	132	251	251
Min.	0.09	0.57	0.09
Average	12.87	17.68	15.18
BkF, ug/g Dust			
Max.	647	291	647
Min.	2.07	1.29	1.29
Average	33.52	24.06	28.97
Number of Filters (N)	27	25	52

TABLE 11

Summary of Annual Results: Hamilton, Sta. 29008

Time Period	First Year 3/7/71 to 21/7/72	Second Year 29/7/72 to 24/7/73	First & Second Year 3/7/71 to 24/7/73
BaP, ug/1000m^3 Air			
Max.	9.38	23.4	23.4
Min.	0.01	0.06	0.01
Average	1.86	2.94	2.38
BkF, ug/1000m^3 Air			
Max.	9.59	45.7	45.7
Min.	0.05	0.15	0.05
Average	2.56	4.83	3.65
Dust, ug/m^3 Air			
Max.	301.0	388.8	388.8
Min.	55.6	37.2	37.2
Average	139.5	149.2	144.2
BaP, ug/g Dust			
Max.	94.6	119	119
Min.	0.11	0.7	0.11
Average	12.13	13.32	12.7
BkF, ug/g Dust			
Max.	96.8	137	137
Min.	0.60	1.71	0.60
Average	16.05	20.74	18.3
Number of Filters (N)	27	25	52

TABLE 12

Summary of Annual Results: Sault Ste. Marie, Sta. 71021

Time Period	First Year 4/7/71 to 13/7/72	Second Year 10/10/72 to 16/7/73	First & Second Year 4/7/71 to 16/7/73
BaP, ug/1000m^3 Air			
Max.	1.16	22.5	22.5
Min.	0.02	0.05	0.02
Average	0.31	1.88	0.98
BkF, ug/1000m^3 Air			
Max.	2.18	34.0	34
Min.	0.09	0.14	0.09
Average	0.44	3.49	1.75
Dust, ug/m^3 Air			
Max.	169.2	154.0	169.2
Min.	25.9	16.5	16.5
Average	67.4	64.2	66.0
BaP, ug/g Dust			
Max.	20.9	208	208
Min.	0.31	1.39	0.31
Average	5.51	20.67	12.01
BkF, ug/g Dust			
Max.	53	313	313
Min.	1.43	1.52	1.43
Average	8.37	31.32	18.21
Number of Filters (N)	20	15	35

TABLE 13

Summary of Annual Results: Cornwall, Sta. 56051

Time Period	First Year 2/7/71 to 30/6/72	Second Year 3/10/72 to 16/7/73	First & Second Year 2/7/71 to 16/7/73
BaP, ug/1000m^3 Air			
Max.	1.80	6.70	6.70
Min.	0.02	0.01	0.01
Average	0.43	0.57	0.50
BkF, ug/1000m^3 Air			
Max.	3.58	19.5	19.5
Min.	0.06	0.11	0.06
Average	0.70	1.56	1.12
Dust, ug/m^3 Air			
Max.	129.5	107.7	129.5
Min.	29.4	23.8	23.8
Average	69.1	57.5	63.5
BaP, ug/g Dust			
Max.	26.5	163	163
Min.	0.67	0.10	0.10
Average	6.94	11.75	9.29
BkF, ug/g Dust			
Max.	52.5	475	475
Min.	1.65	3.84	1.65
Average	11.45	32.58	21.77
Number of Filters (N)	22	21	43

TABLE 14

Summary of Annual Results: Ottawa, Sta. 51001

Time Period	First Year 3/7/71 to 1/7/72	Second Year 30/7/72 to 16/7/73	First & Second Year 3/7/71 to 16/7/73
BaP, ug/1000m^3 Air			
Max.	1.40	1.85	1.85
Min.	0.06	<0.01	<0.01
Average	0.41	0.31	0.37
BkF, ug/1000m^3 Air			
Max.	1.86	1.70	1.86
Min.	0.08	<0.01	<0.01
Average	0.52	0.39	0.46
Dust, ug/m^3 Air			
Max.	260.6	325.7	325.7
Min.	19.5	16.4	16.4
Average	89.2	65.1	78.1
BaP, ug/g Dust			
Max.	23.7	21.1	23.7
Min.	0.87	1.08	0.87
Average	4.97	5.56	5.23
BkF, ug/g Dust			
Max.	19.5	26.1	26.1
Min.	0.97	2.08	0.97
Average	5.74	7.41	6.48
Number of Filters (N)	26	22	48

TABLE 15

Summary of Annual Results: North Bay, Sta. 75020

Time Period	First Year 4/7/71 to 13/7/72	Second Year 29/7/72 to 16/7/73	First & Second Year 4/7/71 to 16/7/73
BaP, ug/1000m^3 Air			
Max.	0.96	15.6	15.6
Min.	0.05	0.03	0.03
Average	0.19	0.92	0.56
BkF, ug/1000m^3 Air			
Max.	1.04	7.35	7.35
Min.	0.06	0.03	0.03
Average	0.26	0.62	0.44
Dust, ug/m^3 Air			
Max.	117.9	94.8	117.9
Min.	21.7	15.3	15.3
Average	55.1	41.0	48.0
BaP, ug/g Dust			
Max.	35.9	164	164
Min.	0.64	1.0	0.64
Average	4.72	13.42	9.07
BkF, ug/g Dust			
Max.	23.7	77.5	77.5
Min.	1.08	0.68	0.68
Average	5.54	11.21	8.38
Number of Filters (N)	24	24	48

TABLE 16

Summary of Annual Results: Toronto (College St.) Sta, 31001

Time Period	First Year 3/7/71 to 12/7/72	Second Year 28/7/72 to 24/7/73	First & Second Year 3/7/71 to 24/7/73
BaP, ug/1000m^3 Air			
Max.	2.95	4.27	4.27
Min.	0.06	0.04	0.04
Average	0.54	0.62	0.58
BkF, ug/1000m^3 Air			
Max.	4.21	4.38	4.38
Min.	0.14	0.05	0.05
Average	0.72	0.73	0.73
Dust, ug/m^3 Air			
Max.	279.4	1019	1019
Min.	43.2	41.1	41.1
Average	112.1	148.2	129.5
BaP, ug/g Dust			
Max.	15.0	32.4	32.4
Min.	0.80	0.94	0.80
Average	4.25	5.0	4.61
BkF, ug/g Dust			
Max.	22.5	33.20	33.20
Min.	1.62	1.12	1.12
Average	5.57	6.03	5.79
Number of Filters (N)	29	27	56

TABLE 17

Summary of Annual Results: Toronto (Hwy. 401), Sta. 33002

Time Period	First Year 11/7/71 to 13/7/72	Second Year 29/7/72 to 16/7/73	First & Second Year 11/7/71 to 16/7/73
BaP, ug/1000m^3 Air			
Max.	1.43	1.70	1.70
Min.	0.05	0.07	0.05
Average	0.49	0.46	0.60
BkF, ug/1000m^3 Air			
Max.	2.24	1.44	2.24
Min.	0.17	0.09	0.09
Average	0.54	0.51	0.53
Dust, ug/m^3 Air			
Max.	290.3	322.4	322.4
Min.	79.7	67.8	67.8
Average	158.5	148.8	153.6
BaP, ug/g Dust			
Max.	9.07	19.2	19.2
Min.	0.66	0.59	0.59
Average	3.10	3.48	3.29
BkF, ug/g Dust			
Max.	14.2	16.2	16.2
Min.	1.22	0.45	0.45
Average	3.58	3.77	3.68
Number of Filters (N)	23	23	46

TABLE 18

Summary of Annual Results: Sarnia, Sta. 14051

Time Period	First Year 3/7/71 to 14/7/72	Second Year 26/7/72 to 21/7/73	First & Second Year 3/7/71 to 21/7/73
BaP, ug/1000m^3 Air			
Max.	0.72	4.31	4.31
Min.	0.02	0.01	0.01
Average	0.17	0.36	0.26
BkF, ug/1000m^3 Air			
Max.	1.55	5.18	5.18
Min.	0.08	0.04	0.04
Average	0.26	0.46	0.35
Dust, ug/m^3 Air			
Max.	235.1	189.2	235.1
Min.	45.4	35.4	35.4
Average	107.0	99.5	103.5
BaP, ug/g Dust			
Max.	8.76	23.9	23.9
Min.	0.17	0.04	0.04
Average	1.59	3.20	2.35
BkF, ug/g Dust			
Max.	6.58	28.7	28.7
Min.	0.76	0.49	0.49
Average	2.44	4.20	3.27
Number of Filters (N)	27	24	51

TABLE 19

Summary of Annual Results: Sudbury, Sta. 77016

Time Period	First Year 3/7/71 to 9/7/72	Second Year 27/7/72 to 18/7/73	First & Second Year 3/7/71 to 18/7/73
BaP, ug/1000m^3 Air			
Max.	0.67	0.22	0.67
Min.	<0.01	0.02	<0.01
Average	0.08	0.10	0.09
BkF, ug/1000m^3 Air			
Max.	0.27	0.28	0.28
Min.	0.01	0.05	0.01
Average	0.10	0.12	0.11
Dust, ug/m^3 Air			
Max.	182.8	161.2	182.8
Min.	32.3	20.6	20.6
Average	68.2	59.6	63.9
BaP, ug/g Dust			
Max.	19.3	7.95	19.3
Min.	0.12	0.33	0.12
Average	1.54	2.10	1.82
BkF, ug/g Dust			
Max.	7.33	5.75	7.33
Min.	0.18	0.59	0.18
Average	1.71	2.48	2.09
Number of Filters (N)	25	25	50

FIGURE 11

Benzo(a)Pyrene in Urban Air

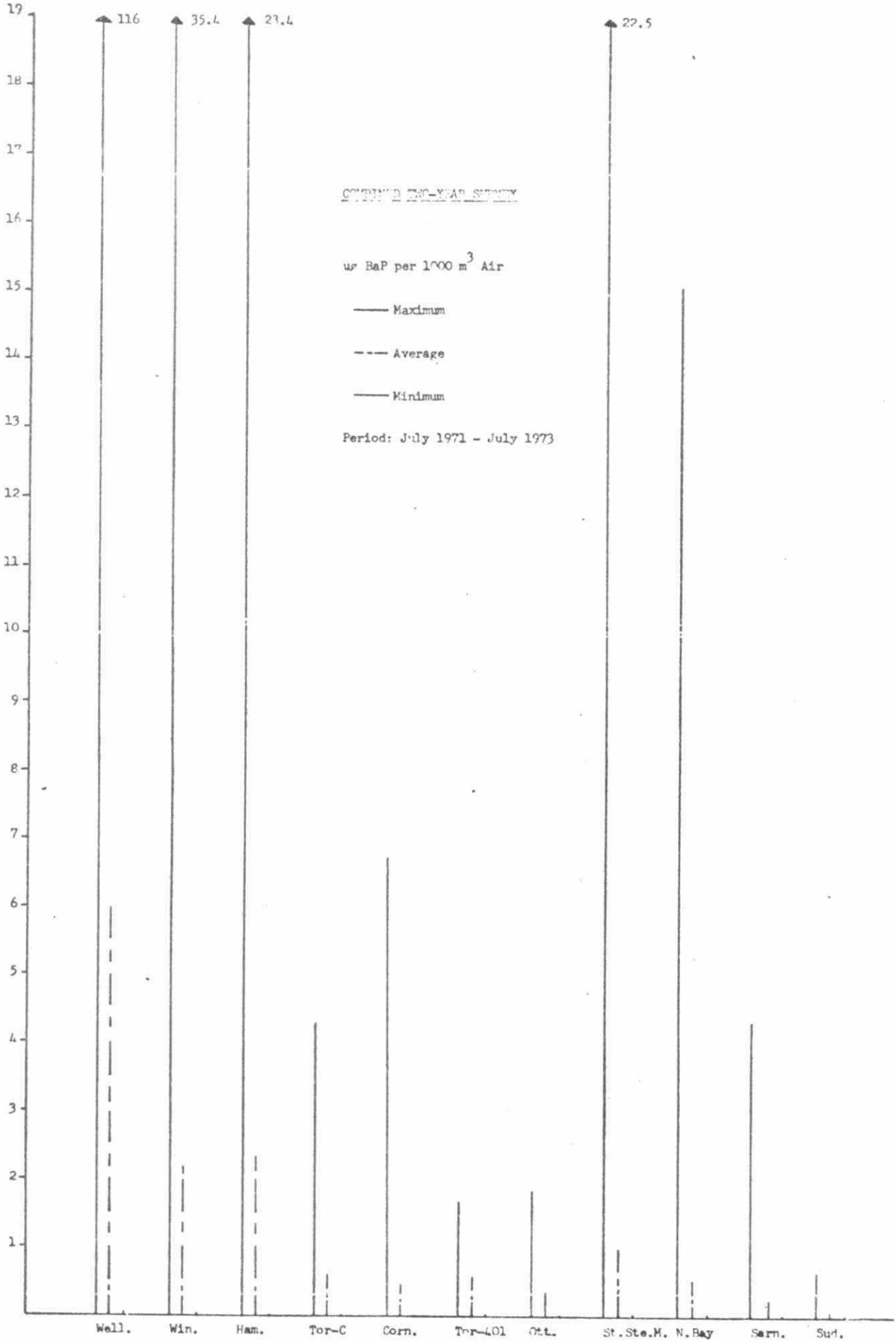


FIGURE 12

Benzo (k) Fluoranthene in Urban Air

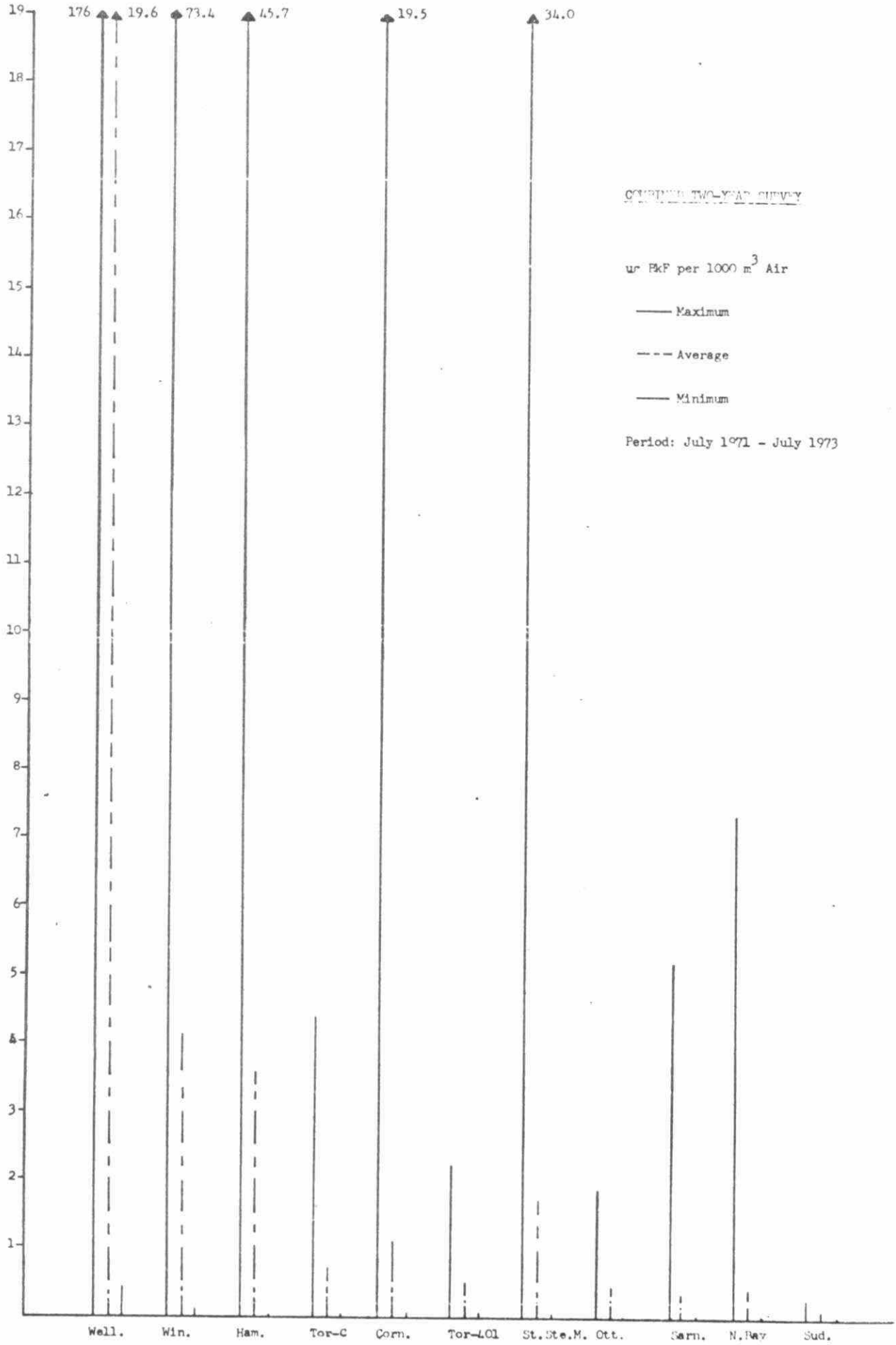


FIGURE 13

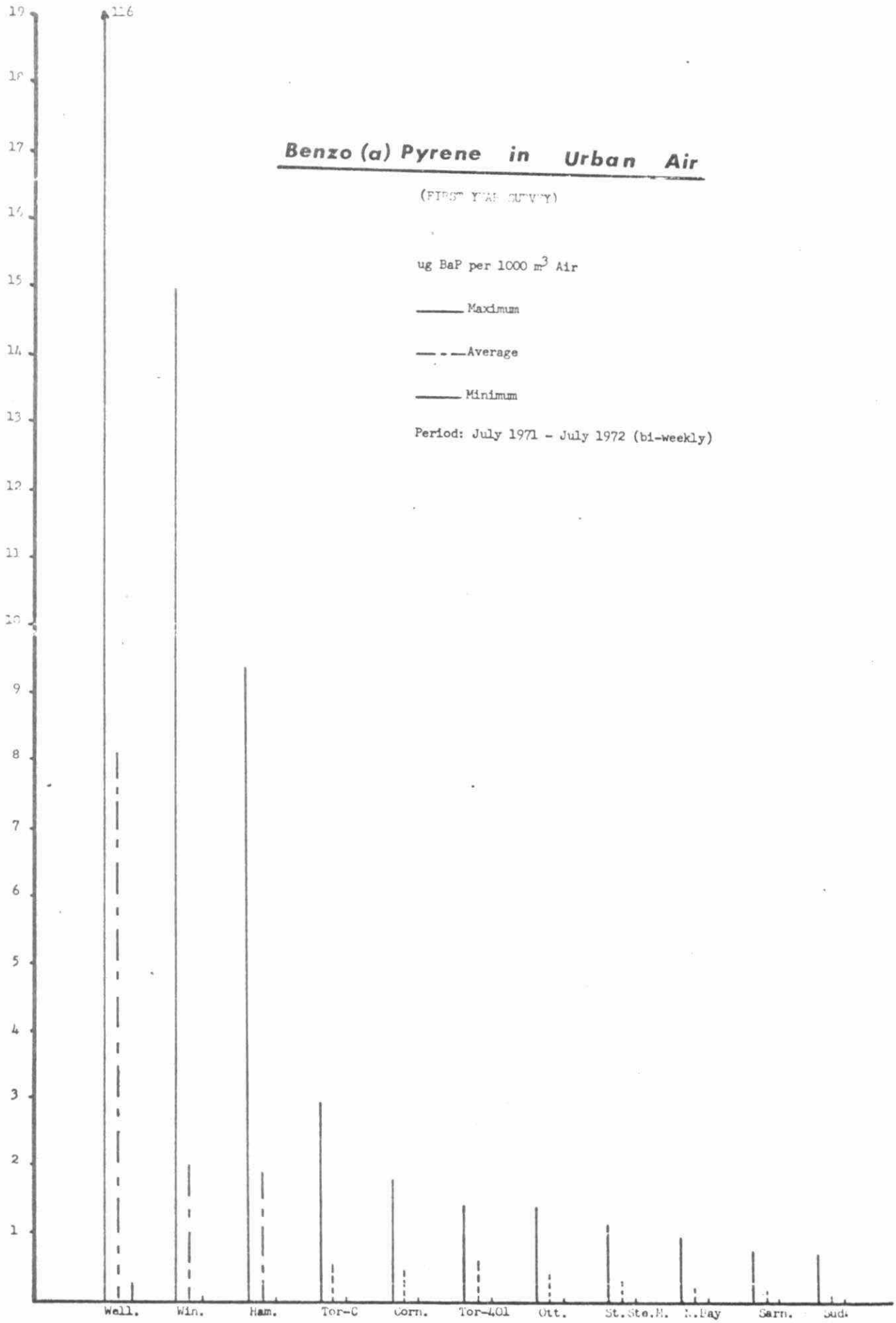

Benzo (a) Pyrene in Urban Air
(FIRST YEAR SURVEY)
ug BaP per 1000 m3 Air
Maximum
Average
Minimum
Period: July 1971 - July 1972 (bi-weekly)
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
11.6
Well.
Win.
Ham.
Tor-C
Corn.
Tor-401
Ott.
St.Ste.M.
N.Bay
Sarn.
Sud.

FIGURE 14

Benzo(a) Pyrene in Urban Air

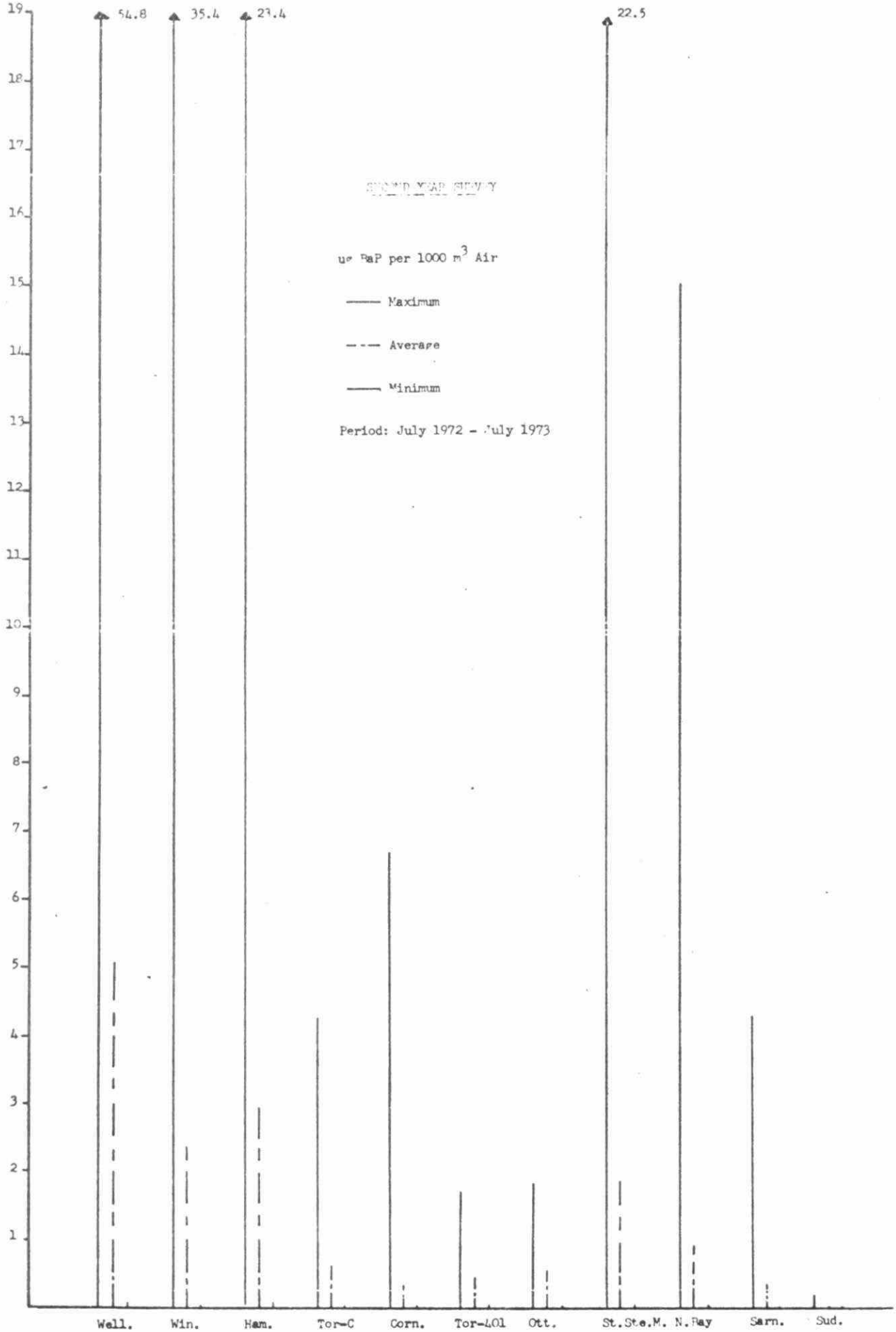


FIGURE 15

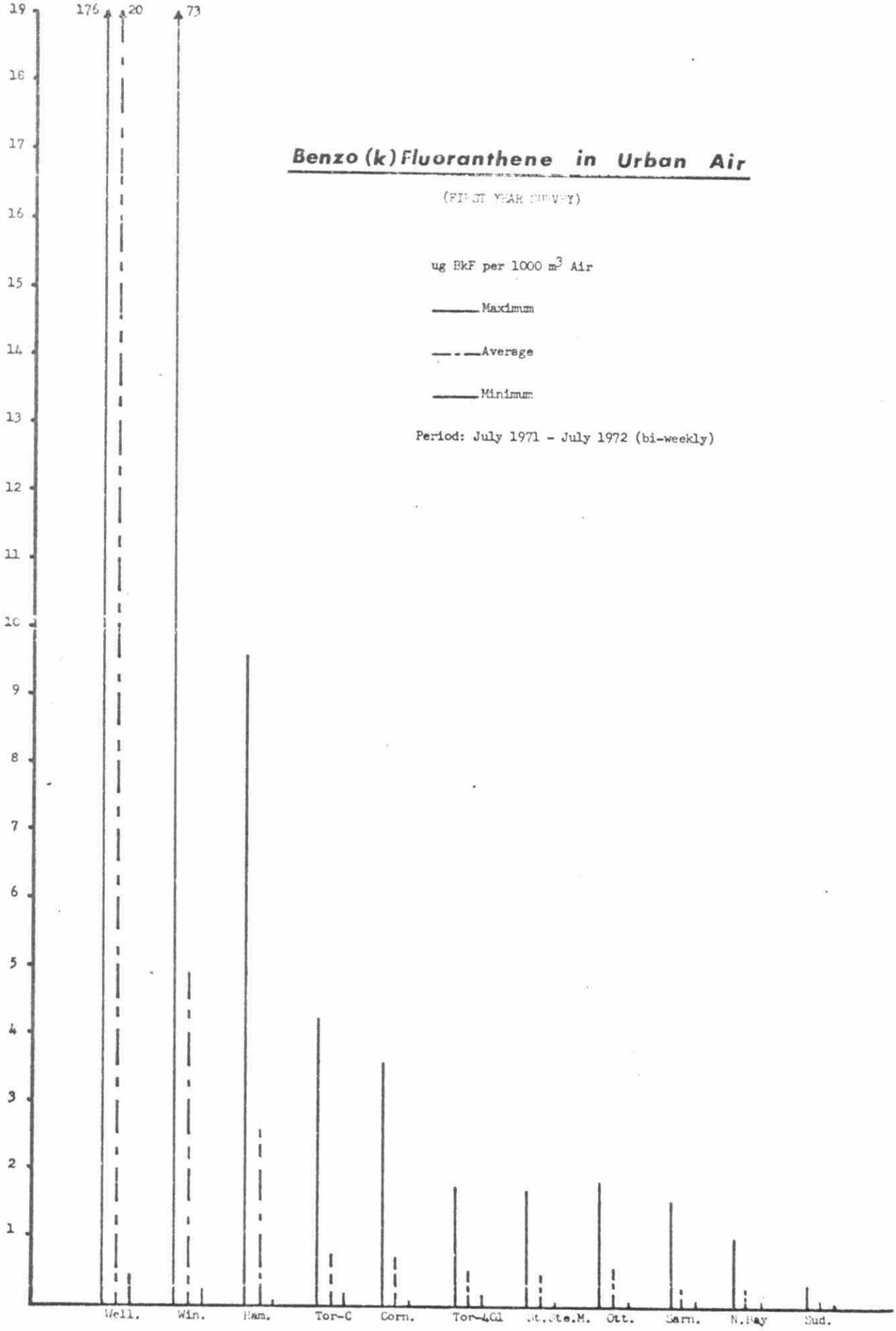
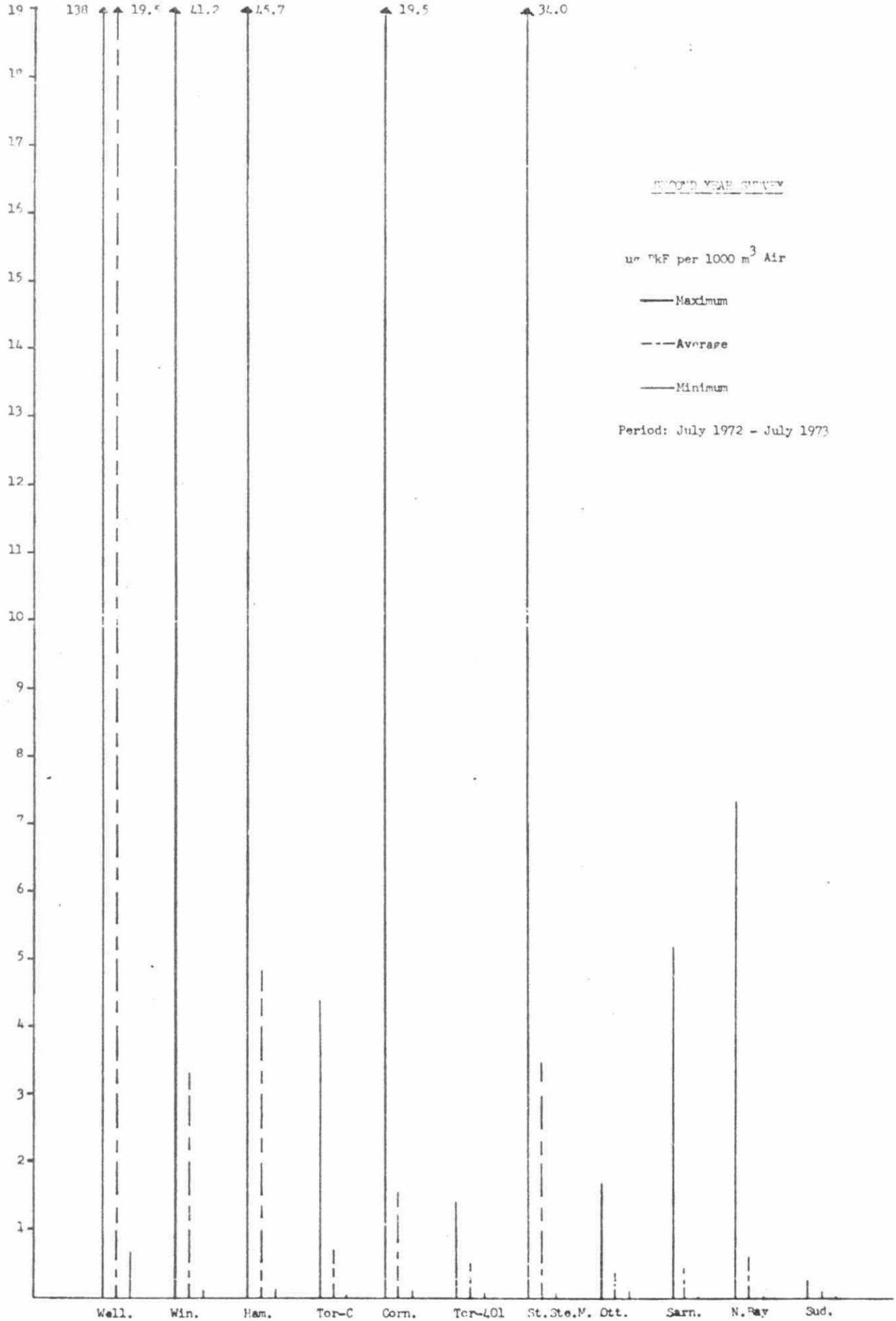

Benzo (k) Fluoranthene in Urban Air
(FIRST YEAR SURVEY)
ug BkF per 1000 m3 Air
Maximum
Average
Minimum
Period: July 1971 - July 1972 (bi-weekly)
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
176
20
73
Well.
Win.
Ham.
Tor-C
Corn.
Tor-4Cl
St.Ste.M.
Ott.
Sarn.
N.Bay
Sud.

FIGURE 16

Benzo (k) Fluoranthene in Urban Air



2) Time Period of Sampling and PAH Level

One of the aims of this survey was to determine any correlations which may exist in certain communities between pollutant levels and the time period or date of sampling, such as year, season, month or day of the week when High-Volume filter samples were taken.

Differences in BaP, BkF and dust levels for the first and second years of this survey were briefly mentioned in the foregoing paragraphs for each community. As shown in Tables 9 to 19 and, graphically, in Figures 13 to 16, the BaP and BkF levels (maximum and average) were higher in the second year for almost all communities. Among the exceptions was Welland with lower maximum PAH levels but with little change in average levels in the second year. There was also little change in the average dust levels for most communities but large increases in the maximum levels for the second year were observed for Welland and Toronto (College Street).

Seasonal correlations were established by dividing the year into a Warm Season (March 1 to October 31) and a Cold Season (November 1 to April 30). Definite trends toward higher average BaP as well as BkF levels in the Cold Season could be established for almost all Stations during the first year of the survey (Tables 20 and 21). Such trends toward higher PAH levels in winter time are well known and reported in the literature (49, 50, 51) and are believed to be the result of heating and additional fuel consumption during the Cold Season.

However, during the second year this trend reversed itself partially when only 4 out of 11 Stations were found to have higher average PAH levels in the Cold Season (Tables 22 and 23).

A similar trend was also observed for the average dust levels with only 4 Stations showing higher levels in the Cold Season. These stations were located in the industrial communities of Welland, Windsor, Hamilton and on Highway 401 in Toronto (Tables 24 and 25). Needless to say, average dust levels were expected to be higher during the Warm Season with the influence of vegetation and the absence of extensive snow cover. In the aforesaid industrial communities, however, increased burning of heating fuel in the Cold Season could have caused a corresponding rise in stack emissions of dust into the atmosphere. The exceptionally high dust levels at Highway 401 in Toronto during the Cold Season could be explained by the vast amounts of crude salt (and associated particulate impurities) spread on this highway in winter time.

In Table 26 the additive effect of the change in pollutant levels from the Warm to the Cold Season for both years of the survey is shown. While there were generally lower average levels of dust in the Cold Season for most Stations, only about half of the Stations showed lower average BaP and BkF levels. The average levels of BaP and BkF in the Warm and Cold Seasons for each of the two years are graphically depicted in Figures 17 and 18. In addition to comparisons of

pollutant levels in the Warm with those in the Cold Seasons, pollutant levels in the Warm Season of one year were also compared with those of the same season in the other year of the survey (Table 27). The same was done with the pollution levels of the Cold Seasons in these two years (Table 28). From the two Tables it became quite evident that the generally higher levels for BaP and BkF in the second year originated predominantly from higher levels during the Warm Season of that (second) year, while the trend during the Cold Season was opposite, although at a lower rate. This conclusion seemed surprising and would make the continuation of this survey for a further period appear desirable in order to establish whether there is a long term trend in these seasonal changes or not.

As far as the changes in average dust levels from the first to the second year, for the same season, are concerned, the results in Tables 27 and 28 indicate mostly a drop in these levels in the second year of this survey. However, this trend is less clearly defined than that of the corresponding changes in the average PAH levels and goes in the opposite direction.

Apart from showing seasonal changes in the levels of these pollutants, no attempts have been made to relate changes in these levels to the calendar month or the day of the week. It was felt that for such a study, a considerably larger number of data, i.e. data from several years of survey, would be required before any statistically meaningful

TABLE 20

Seasonal Averages* of BaP in First Year

(July 1971 to July 1972)

Location	Station No.	Warm Season ug/1000m^3 Air		Cold Season ug/1000m^3 Air		% Change from Warm to Cold Season
		N**		N**		
Welland	27027	18	6.0	13	11.6	+93
Windsor	12008	15	1.9	12	2.2	+16
Hamilton	29008	15	1.8	12	1.9	+6
Toronto (College St.)	31001	16	0.55	13	0.54	-2
Cornwall	56051	12	0.45	10	0.41	-9
Toronto (Hwy. 401)	33002	12	0.33	11	0.67	+103
Sault Ste Marie	71021	11	0.31	9	0.30	-3
Ottawa	51001	14	0.29	12	0.56	+93
Sarnia	14051	15	0.13	12	0.21	+62
North Bay	75020	13	0.14	11	0.25	+79
Sudbury	77016	13	0.05	12	0.12	+140

* Warm Season = March 1 to October 31

Cold Season = November 1 to April 30

** N = Number of High-Volume filter samples.

TABLE 21

Seasonal Averages* of BkF in First Year

(July 1971 to July 1972)

Location	Station No.	Warm Season ug/1000m^3 Air		Cold Season ug/1000m^3 Air		% Change from Warm to Cold Season
		N**		N**		
Welland	27027	18	15.6	13	27.1	+74
Windsor	12008	15	7.0	12	2.3	-67
Hamilton	29008	15	2.3	12	2.8	+22
Toronto (College St.)	31001	16	0.64	13	0.83	+30
Cornwall	56051	12	0.71	10	0.68	- 4
Toronto (Hwy. 401)	33002	12	0.40	11	0.70	+75
Sault Ste Marie	71021	11	0.38	9	0.52	+37
Ottawa	51001	14	0.34	12	0.72	+112
Sarnia	14051	15	0.21	12	0.31	+48
North Bay	75020	13	0.24	11	0.29	+21
Sudbury	77016	13	0.06	12	0.14	+133

* Warm Season = March 1 to October 31

Cold Season = November 1 to April 30

** N = Number of High-Volume Filter Samples

TABLE 22

Seasonal Averages* of BaP in Second Year

(July 1972 to July 1973)

Location	Station No.	Warm Season ug/1000m^3 Air		Cold Season ug/1000m^3 Air		% Change from Warm to Cold Season
		N**		N**		
Welland	27027	23	5.53	51	4.76	-14
Windsor	12008	13	0.97	12	3.89	+301
Hamilton	29008	13	4.69	12	1.05	-78
Toronto (College St.)	31001	14	0.58	13	0.71	+22
Cornwall	56051	9	1.00	12	0.25	-75
Toronto (Hwy. 401)	33002	11	0.52	12	0.40	-23
Sault Ste Marie	71021	7	3.72	8	0.26	-93
Ottawa	51001	10	0.35	12	0.29	-17
Sarnia	14051	14	0.49	10	0.19	-61
North Bay	75020	12	0.37	12	1.47	+297
Sudbury	77016	13	0.09	12	0.11	+22

* Warm Season = March 1 to October 31

Cold Season = November 1 to April 30

** N = Number of High-Volume filter samples.

TABLE 23

Seasonal Averages* of BkF in Second Year

(July 1972 to July 1973)

Location	Station No.	Warm Season ug/1000m^3 Air		Cold Season ug/1000m^3 Air		% Change from Warm to Cold Season
		N**		N**		
Welland	27027	23	15.73	51	20.78	+32
Windsor	12008	13	1.81	12	4.96	+174
Hamilton	29008	13	7.87	12	1.54	-80
Toronto (College St.)	31001	14	0.68	13	0.80	+18
Cornwall	56051	9	2.93	12	0.49	-84
Toronto (Hwy. 401)	33002	11	0.57	12	0.46	-19
Sault Ste Marie	71021	7	7.04	8	0.39	-94
Ottawa	51001	10	0.47	12	0.33	-30
Sarnia	14051	14	0.59	10	0.29	-51
North Bay	75020	12	0.42	12	0.83	+98
Sudbury	77016	13	0.13	12	0.12	-8

* Warm Season = March 1 to October 31

Cold Season = November 1 to April 30

** N = Number of High-Volume filter samples.

TABLE 24

Seasonal Averages* of Dust in First Year

(July 1971 to July 1972)

Location	Station No.	Warm Season ug/1000m^3 Air		Cold Season ug/1000m^3 Air		% Change from Warm to Cold Season
		N**		N**		
Welland	27027	18	238.64	13	264.14	+11
Windsor	12008	15	157.06	12	154.08	-2
Hamilton	29008	15	131.70	12	149.22	+13
Toronto (College St.)	31001	16	131.32	13	88.36	-33
Cornwall	56051	12	82.88	10	52.61	-37
Toronto (Hwy. 401)	33002	13	134.62	11	295.44	+119
Sault Ste Marie	71021	11	68.43	9	66.12	-3
Ottawa	51001	14	98.06	12	78.75	-20
Sarnia	14051	15	118.05	12	93.26	-21
North Bay	75020	13	60.66	11	48.44	-20
Sudbury	77016	13	78.23	12	57.32	-27

* Warm Season = March 1 to October 31

Cold Season = November 1 to April 30

** N = Number of High-Volume filter samples.

TABLE 25

Seasonal Averages* of Dust in Second Year

(July 1972 to July 1973)

Location	Station No.	Warm Season ug/1000m^3 Air		Cold Season ug/1000m^3 Air		% Change from Warm to Cold Season
		N**		N**		
Welland	27027	23	240.53	51	220.31	-8
Windsor	12008	13	119.04	12	137.22	+15
Hamilton	29008	13	174.87	12	121.39	-31
Toronto (College St.)	31001	14	189.08	13	104.10	-45
Cornwall	56051	9	59.26	12	56.25	-5
Toronto (Hwy. 401)	33002	11	130.08	12	165.94	+28
Sault Ste Marie	71021	7	86.87	8	44.32	-49
Ottawa	51001	10	87.12	12	46.8	-46
Sarnia	14051	14	116.53	10	75.73	-35
North Bay	75020	12	48.55	12	33.48	-31
Sudbury	77016	13	59.49	12	59.64	+0.25

* Warm Season = March 1 to October 31

Cold Season = November 1 to April 30

** N = Number of High-Volume filter samples.

TABLE 26

Changes in Seasonal Average Levels
(from Warm to Cold Season)[1]
During the Two-Year Period[2]

Location	Station	Dust % Change	BkF % Change	BaP % Change
Welland	27027	+1	+53	+42
Windsor	12008	+6	-18	+111
Hamilton	29008	-12	-57	-54
Toronto (College St.)	31001	-40	+24	+11
Cornwall	56051	-23	-68	-54
Toronto (Hwy. 401)	33002	+74	+21	+29
Sault Ste Marie	71021	-29	-88	-86
Ottawa	51001	-32	+30	+31
Sarnia	14051	-28	-25	-36
North Bay	75020	-25	+70	+231
Sudbury	77016	-15	+30	+71

[1] Warm Season: May 1 to October 31

Cold Season: November 1 to April 30

[2] July 1971 to July 1973

TABLE 27

Changes in Warm Season Average Levels[1]

from First to Second Year[2]

Location	Station	Dust % Change	BkF % Change	BaP % Change
Welland	27027	+0.8	+9.8	-8
Windsor	12008	-24	-74	-49
Hamilton	29008	+33	+242	+161
Toronto (College St.)	31001	+44	+6	+6
Cornwall	56051	-28	+320	+122
Toronto (Hwy. 401)	33002	-3	+42	+58
Sault Ste Marie	71021	+27	+1753	+1100
Ottawa	51001	-11	+39	+21
Sarnia	14051	-1	+181	+277
North Bay	75020	-20	+75	+164
Sudbury	77016	-24	+117	+89

(1) Warm Season: May 1 to October 31

(2) First Year: July 1971 to July 1972

Second Year: July 1972 to July 1973

TABLE 28

Changes in Cold Season Average Levels[1]

from First to Second Year[2]

Location	Station	Dust % Change	BkF % Change	BaP % Change
Welland	27027	-17	-23	-59
Windsor	12008	-11	+116	-77
Hamilton	29008	-19	-45	-45
Toronto (College St.)	31001	+18	-4	+32
Cornwall	56051	+7	-28	-39
Toronto (Hwy. 401)	33002	-44	-34	-40
Sault Ste Marie	71021	-33	-25	-13
Ottawa	51001	-41	-54	-48
Sarnia	14051	-19	-6	-10
North Bay	75020	-31	+186	+488
Sudbury	77016	+4	-14	-8

(1) Cold Season: November 1 to April 30

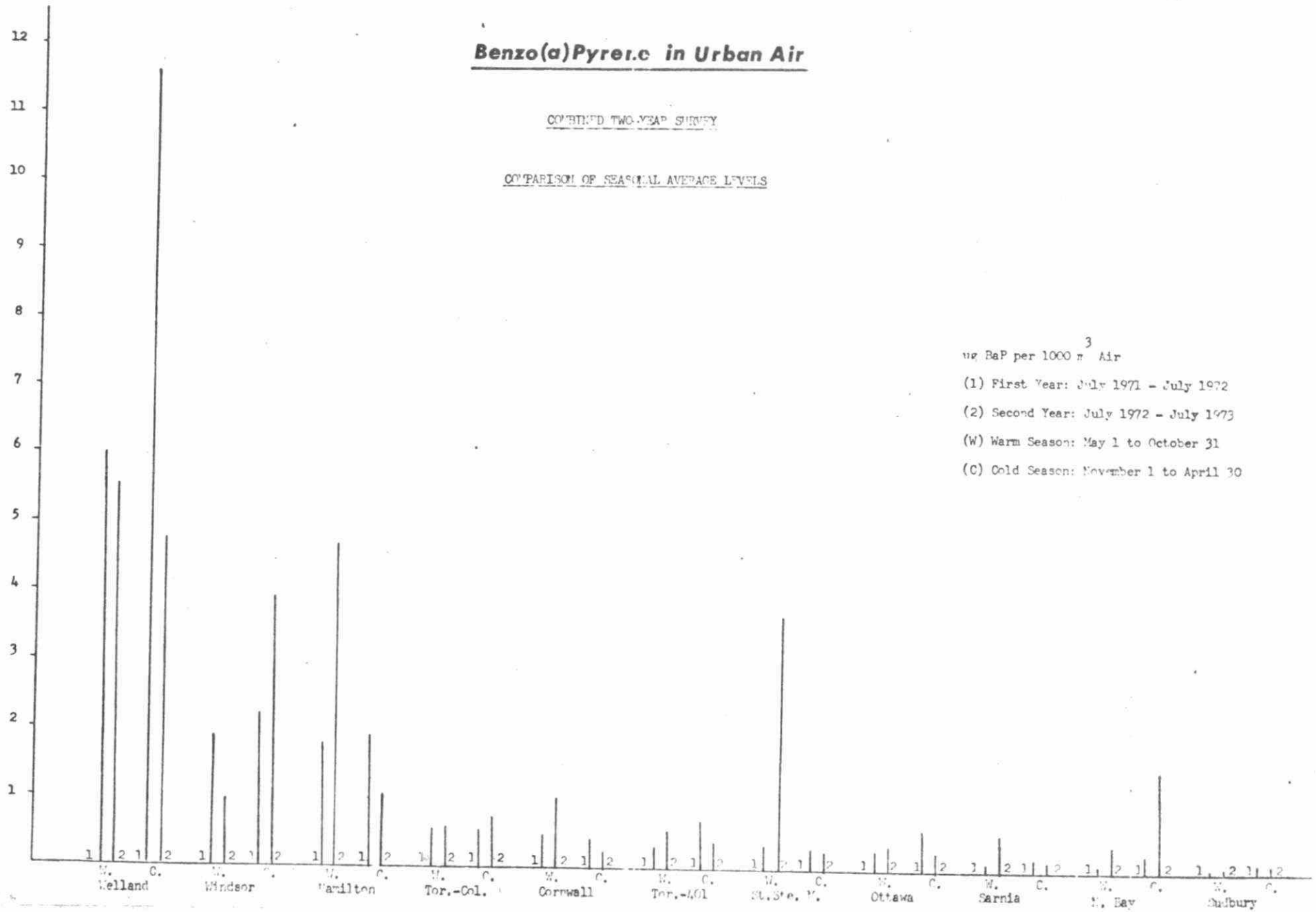
(2) First Year: July 1971 to July 1972

Second Year: July 1972 to July 1973

Benzo(a)Pyrene in Urban Air

COMBINED TWO-YEAR SURVEY

COMPARISON OF SEASONAL AVERAGE LEVELS



ug BaP per 1000 m^3 Air

(1) First Year: July 1971 - July 1972

(2) Second Year: July 1972 - July 1973

(W) Warm Season: May 1 to October 31

(C) Cold Season: November 1 to April 30

FIGURE 17

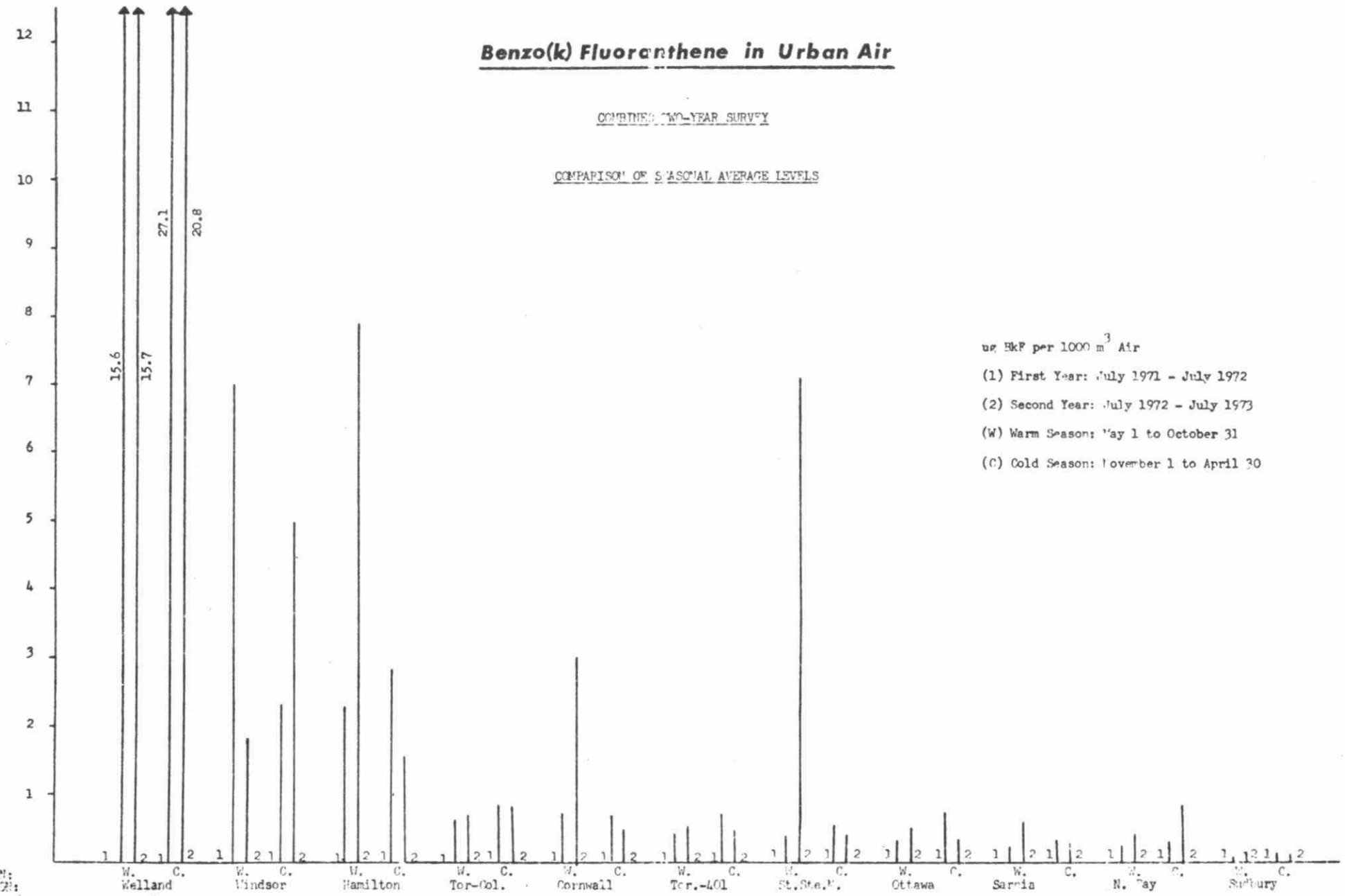

Benzo(k) Fluoranthene in Urban Air
COMBINED TWO-YEAR SURVEY
COMPARISON OF SEASONAL AVERAGE LEVELS
ug BkF per 1000 m3 Air
(1) First Year: July 1971 - July 1972
(2) Second Year: July 1972 - July 1973
(W) Warm Season: May 1 to October 31
(C) Cold Season: November 1 to April 30
15.6
15.7
27.1
20.8
YEAR:
SEASON:
STATION:
W. C.
Welland
Windsor
Hamilton
Tor-Col.
Cornwall
Tor.-401
St.Ste.M.
Ottawa
Sarnia
N. Bay
Sudbury

FIGURE 18

investigation on whether or not such correlations exist, could be made, In Tables 38-A to 48-D, the days of the week on which the sampling was done were listed for future reference along with the calendar dates.

3) Influence of Wind Direction on PAH Level

The influence of the prevailing wind directions on the BaP and BkF concentrations was highly significant in certain high-level industrial communities while it was small or non-existent in the lower-level communities. Most striking was the effect of wind direction during the two-year survey in the Welland, Windsor, and Hamilton areas where peaks in pollution levels coincided in most cases with winds from the direction of suspected industrial areas.

Welland showed relatively high BaP and BkF levels with winds from the west to northwest, i.e. from the direction of the Union Carbide Company (Figures 19-A, 19-B, 19-C). Most peak levels in Windsor were with winds from the northwest and southwest, which are the general directions of Detroit's major industries and power plants across the Detroit River (Figures 20-A and 20-B). At the Station located just east of Hamilton's large steel mills and carbon-black plant, virtually all peaks in BaP and BkF and dust levels occurred when the winds were from the west and northwest (Figures 21-A and 21-B).

PAH levels were relatively low in Toronto. Peak levels showed a definite correlation with wind direction from the east. In this direction, extensive industrial emission sources are located closer to the city centre, i.e. to the College Street Station, than in other directions (Figures 24-A and 24-B).

Still lower pollution levels than in Toronto were found in Sarnia, where a large petrochemical industry is located south of the sampling Station. Nevertheless, a noticeable trend for peaks in PAH and dust levels was found with generally southerly winds (Figures 28-A and 28-B).

The correlations of peak pollution levels with certain wind directions provide strong evidence as to the location of the pollution sources for the above communities. Further evidence to this effect is also provided, in that the High-Volume Stations were located downwind from the main suspected pollution sources and thus relatively high levels of pollution were found to occur more frequently.

4) Influence of Wind Speed on PAH Level

Unlike the wind direction, the average wind speed seemed of little significance for the levels of BaP and BkF observed. The assumption that higher wind speeds (such as in

the 10 to 20 MPH range) would have a dispersing influence on air pollutants and, as a consequence, would lead to a decrease in the pollutant levels, was not borne out from the data available (Tables 38-A and 48-D).

In fact, the highest BaP and BkF levels recorded in this survey (Welland, March 23, 1972) were with northwesterly winds at 15.2 MPH. Other extremely high pollution readings for the same area occurred with average wind speeds of 17.5 MPH on both October 9, 1972 and January 29, 1973.

Inspection of the data for Windsor and Hamilton showed similarly that high winds often prevailed during periods of high BaP and BkF levels. Thus, the highest levels for Windsor were recorded on January 22, 1973 when the average wind speed was 15.6 MPH. Another very high pollution level was on May 9, 1972 at an average wind speed of 17.1 MPH. High pollution levels at Hamilton were found on February 13, 1972 and on January 13, 1973 at average wind speeds between 10 and 15 MPH.

In Toronto, the highest BaP and BkF levels of the two-year survey were observed on November 10, 1972 when the average wind speed was 18.1 MPH. Highest PAH levels coincided also at Sarnia on May 16, 1973 with 17.0 MPH winds. At North Bay, the only high reading for these pollutants in the entire two-year period was recorded on April 19, 1973 at an average wind speed of 10.4 MPH.

However, while the above evidence has shown that relatively high winds did not result in essentially lower BaP and BkF levels in the affected areas, low winds and virtual calms, sometimes observed during temperature inversions, did not have a beneficial effect either. Therefore it appears that presumably with the exception of very powerful winds or storms, wind speed has hardly a dispersing or "diluting" effect upon the pollution levels in an area downwind of a large pollution source.

5) Coefficient of Haze and PAH Level

In attempts to establish a possible correlation of the BaP and BkF levels with the corresponding COH-values, these values were plotted, as available, in Figures 19-A to 29-B. See also Tables 38-A to 48-D for the numerical COH-values. For most communities, only a qualitative and rather approximate correlation seemed to exist which gave little justification for using it as a basis for establishing concentration levels of these polynuclear hydrocarbon compounds in urban atmospheres. Obviously there are other factors and pollutants which can exert over-riding influences upon the COH-values and which can interfere with such a correlation, if any.

However, during the two temperature inversion periods in Southern Ontario, the plotted COH-values followed closely the steeply rising concentration levels of BaP and BkF. During such periods, of course, a general accumulation of all types of pollutants was taking place which included those with a dominant effect on the COH.

The (Ontario) Air Pollution Index (API) serves as some arbitrary measure of this general type of air pollution. It is a number combining two parameters - the mean concentration of SO_2 over a 24 hour period and the corresponding mean 24-hour COH index. During temperature inversions in Southern Ontario on February 12-13, 1972 and May 1-2, 1972, these API and COH values rose to high levels at Toronto (College St.), Hamilton and Sarnia (Table 29). During the same time periods high BaP and BkF levels were observed which are subject to further discussion in the Chapter on "Temperature Inversion and PAH Level".

TABLE 29

API-Indices and COH-Values During Temperature Inversions (1972)

Station	Feb. 12	Feb. 13	May 1	May 2
Toronto : API (College St.) COH	15-40 1.1	32-45 1.2	23-44 1.2	13-33 0.7
Hamilton : API COH	22-40 1.6	30-41 1.2	29-32 1.5	18-32 0.9
Sarnia : Green- Index COH	 32 1.2	 23 0.9	 19 0.5	 24 0.5

During the inversion period February 12-13, 1972, the API's at Toronto, Hamilton and Windsor rose to 45, 41 and 35, respectively, on February 13, with peaks in Hamilton and Toronto being at 4-5 a.m. Maximum BaP and BkF levels were observed at all

three locations for the same date. For Sarnia, there was no API available, but Ontario Research Foundation used the Green Index. The maximum Index and COH values occurred on February 12, on which day the highest levels for BaP and BkF for the entire year were also observed. Inversion conditions were prevalent over Southern Ontario on both days, with a break-up moving in from the west on February 13, 1972.

During the inversion period May 1-2, 1972, the maximum API and COH values at Toronto and Hamilton were on May 1. In Sarnia neither the Index nor the COH-value was high enough to indicate inversion conditions. This was in line with high PAH levels observed only in Toronto and Hamilton, particularly on May 1, but not in Sarnia.

6) Amount of "Dust" (Airborne Particulates) and PAH Level

As shown in Figures 19-A to 29-B, the BaP and BkF levels followed closely the variations in "dust", or airborne particulate, levels in some industrial areas, while this correlation seemed much less clear for the other areas. It should be noted that the term "dust" refers in this report to "airborne particulates" or "total suspended particulate matter". It appeared that with the generation of airborne particulates by certain industries, the levels of the polynuclear hydrocarbons increased at similar rates. It also appeared that the variations in dust levels were, generally, better in line with the corresponding PAH levels than were the variations in the coefficient of haze values with the PAH levels in these communities.

In non-industrial communities, the probably wind-generated "street dust" seemed to be more independent for the emission of these hydrocarbons, although some dust might have also been generated from fuel burning by domestic sources. As in the case of coefficient of haze values, the variations in dust levels faithfully followed the corresponding BaP and BkF levels in all communities during inversion periods.

The dust levels with their maximum, minimum and average values during the two-year survey are shown in Tables 9 to 19 for each community investigated. A discussion of these levels has been included in the chapters on "Station Location and PAH Level" (pages 53 to 59) and on "Time Period of Sampling" (page 77 to 79); see also Tables 24 to 28. The detailed numerical listing of all dust levels, expressed in ug dust per m^3 air (for 24 hour sampling periods), is shown in Tables 38-A to 48-D.

7) Temperature Inversion and PAH Level

Since the beginning of this survey, four periods of temperature inversion in Southern Ontario have been recognized and investigated: February 12-13, 1972; May 1-2, 1972; October 22-25, 1973: October 28-30, 1974. As already indicated earlier in this report, these periods were marked with a steep increase in the BaP and BkF levels in the following

locations: Toronto, Hamilton, Windsor, Sarnia and Welland. The peaks in these levels can readily be visualized in Figures 19-A, 20-A, 21-A, 24-A, 27-A, 28-A.

The data obtained for the PAH levels during the inversion periods February 12-13, 1972 and May 1-2, 1972 are shown in Table 30.

TABLL 30

BaP and BkF Levels* During Inversion

Location	Station	12/2/72		13/2/72	
		BaP	BkF	BaP	BkF
Toronto	#31001	0.75	2.17	2.52	4.21
Toronto	#33002	1.43	2.24	n.a.	n.a.
Hamilton	#29025	2.29	3.43	5.66	8.66
Sarnia	#14051	0.72	1.55	n.a.	n.a.
Location	Station	1/5/72		2/5/72	
Toronto	#13001	2.00	3.59	0.24	0.67
Toronto	#33002	n.a.	n.a.	0.58	0.55
Hamilton	#29025	9.38	9.59	3.22	6.41
Sarnia	#14049	0.22	0.34	0.32	0.59

* ug/1000m^3 air

From the data for BaP, BkF and dust levels during the period of February 12-13, 1972, the percent increase in those levels over the average levels was calculated (Table 31).

TABLE 31

Percent Increase over Average* During Inversion

Location	Station	12/2/1972			13/2/1972		
		BaP	BkF	Dust	BaP	BkF	Dust
Toronto	#31001	+108	+302	0	+600	+680	+90
Toronto	#33002	+175	+280	0	n.a.	n.a.	n.a.
Hamilton	#29008	+117	+153	+110	n.a.	n.a.	n.a.
Sarnia	#14051	+350	+520	+140	n.a.	n.a.	n.a.

* Ten-month average for period July 1971 to April 1972 (excluding February 12-13 inversion period).

The data show that the steepest rise in PAH-levels in this period occurred on February 13, 1972, with peak levels in Metro Toronto six or seven times higher than the average. Sarnia had maximum levels about four to five times and Hamilton over twice the average levels.

For the inversion period May 1-2, 1972, the percent increase in BaP, BkF and dust levels over the average levels is shown in Table 32.

TABLE 32

Percent Increase over Average* During Inversion

Location	Station	1/5/1972			2/5/1972		
		BaP	BkF	Dust	BaP	BkF	Dust
Toronto	#13001	+456	+565	+180	-33	+24	+50
Toronto	#33002	n.a.	n.a.	n.a.	+12	-7	+60
Hamilton	#29008	n.a.	n.a.	n.a.	-30	-43	+10
Sarnia	#14049	+38	+36	+30	+100	+136	+130

* Ten-month average for period July 1971 to April 1972 (excluding February 12-13 inversion period).

This Table indicates that on May 1, 1972, PAH-levels in Metro Toronto were up to six times higher than the average. On May 1 higher levels than on May 2 were recorded in Toronto and Hamilton, which was in line with the API and COH-values reported under the heading "Coefficient of Haze and PAH Level".

The four-day inversion period between October 22 and October 25, 1973, which affected most of Southern Ontario, was investigated by BaP and BkF analyses of High-Volume filters (as available) from Stations located in Toronto, Hamilton, Windsor, Sarnia and Welland. The results are shown in Tables 33 and 34.

For better comparison with normal atmospheric conditions, average BaP and BkF levels were established for each location by analyzing five to eight High-Volume filters of sampling days preceding and following the inversion period, the sampling days extending from the beginning of October to the middle of November 1973. In addition to these monthly averages, the annual averages of BaP and BkF (over the period from July 1972 to July 1973) served also for comparison with the levels observed during the inversion period. Whenever data for each day of the inversion period were available, the maximum levels during this period were used for calculating the percent increase in these levels over the monthly and annual averages (Table 35).

Thus, the BaP and BkF levels in Toronto increased by seven to eight times during the inversion. At locations in Hamilton and Sarnia these levels rose about three to four-fold, while other stations in the same urban areas and in Windsor showed relatively small increases in these pollutant levels. Welland, which showed even a drop in these levels below the

TABLE 33

BaP Levels[1] in Southern Ontario during Inversion Period

(October 1973)

Date 1973	Toronto #31001	Hamilton #29025	Hamilton #29008	Windsor #12008	Sarnia #14049	Sarnia #14055	Sarnia #14051	Welland #27028
Inversion:								
22/10	2.27	5.52	n.a.	2.56	0.42	n.a.	n.a.	n.a.
23/10	1.78	1.23	n.a.	n.a.	1.18	n.a.	n.a.	n.a.
24/10	3.38	4.31	n.a.	n.a.	1.26	n.a.	n.a.	n.a.
25/10	3.55	11.00	4.39	1.58	0.91	0.33	n.a.	0.26
Oct./Nov. Averages[2]	0.47	3.72	4.76	1.78	0.33	0.31	n.a.	0.72
N	8	5	6	5	6	6	-	6
Annual Averages[3]	0.61	n.a.	2.97	2.38	n.a.	n.a.	0.35	n.a.
N	28	-	26	26	-	-	25	-

1) ug per 1000 m^3 air

2) Excluding inversion period

3) July 1972 to July 1973

TABLE 34

BkF Levels[1] in Southern Ontario during Inversion Period

(October 1973)

Date 1973	Toronto #3001	Hamilton #29025	Hamilton #29008	Windsor #12008	Sarnia #14049	Sarnia #14055	Sarnia #14051	Welland #27028
Inversion:								
22/10	3.70	7.23	n.a.	1.58	0.94	n.a.	n.a.	n.a.
23/10	3.87	2.50	n.a.	n.a.	1.61	n.a.	n.a.	n.a.
24/10	4.65	12.90	n.a.	n.a.	1.57	n.a.	n.a.	n.a.
25/10	5.57	23.20	12.2	4.69	1.27	0.82	n.a.	0.51
Oct./Nov. Averages[2]	0.66	5.06	11.0	3.70	0.59	0.57	n.a.	2.31
N	8	5	6	6	6	6	-	6
Annual Averages[3]	0.73	n.a.	4.94	3.31	n.a.	n.a.	0.45	n.a.
N	28	-	26	26	-	-	25	-

1) ug per 1000 m^3 air

2) Excluding inversion period

3) July 1972 to July 1973

TABLE 35

Percent Increase of BaP during Inversion over Average Levels

Station	Toronto #31001	Hamilton #29025	Hamilton #29008	Windsor #12008	Sarnia #14049	Sarnia #14055	Welland #27028
%Increase over Monthly Average	+655	+196	-8	+44	+282	+6	-64
%Increase over Annual Average	+482	n.a.	+48	+8	n.a.	n.a.	n.a.
Percent Increase of BkF during Inversion over Average Levels							
%Increase over Monthly Average	+744	+359	+11	+27	+173	+44	-78
%Increase over Annual Average	+663	n.a.	+147	+42	n.a.	n.a.	n.a.

(Inversion Period October 22-25, 1973)

average during the same time period, seemed not to be affected by the inversion.

Finally, a temperature inversion, reported for the Toronto area, during the period October 28-30, 1974, was investigated by analysis of High-Volume filters from Station #33001. The results in Table 36 show that the BaP and BkF levels in this period exceeded any levels previously observed in the two-year survey of the same location, including the levels reached in previous inversion periods.

In contrast to the results from the Toronto area, analysis of a High-Volume filter originating from Windsor, Station #12008, on sampling date October 29, 1974, showed no drastically high levels for this area: 1.17 and 2.13 ug/1000m^3 air for BaP and BkF, respectively. High-Volume filters from other urban communities in Southern Ontario were not available for the dates of the inversion period. However, it seems likely that this inversion was confined to the general Toronto area as suggested by meteorological reports.

In conclusion, the analytical results obtained from the investigations of the four temperature inversion periods indicated that the BaP and BkF levels in all locations investigated, with the exception of Welland, rose to well above their maxima for the particular survey year. Concurrent with the extremely high BaP and BkF levels during the

TABLE 36

BaP and BkF Levels* in Toronto during Inversion

(Station #33001)

Inversion Date (1974)	BaP	BkF
October 28	2.82	4.03
October 29	4.08	9.65
October 30	4.37	5.05
Bi-annual Average (July 1971-July 1973)	0.58	0.73
Bi-annual Maximum (July 1971-July 1973)	4.27	4.38

* ug/1000m^3 air

inversion periods, peaks in dust levels and in COH-values were also observed. During these inversion periods, the average wind speeds ranged between 5.3 and 14.0 MPH, indicating again the inefficiency of moderate to fast winds to disperse pollutants downwind from an emission source, particularly when dispersion into higher atmospheric levels is prevented by an inversion layer.

8) Colour of Air Particulate Extract and PAH Level

During work on the present survey, the observation was made that the cyclohexane extracts of High-Volume filters assumed a yellow colour with high BaP and BkF concentration. By adjusting all cyclohexane filter extracts to standard volumes, intensities in the colour were graded visually for comparison with the BaP and BkF concentrations established by fluorometry (Figures 19A-29B).

When it was found that a surprisingly close correlation existed between the colour intensities of the filter extracts and the BaP and BkF concentrations, the opportunity arose for the possible development of a fast and inexpensive method for quantitatively estimating polynuclear aromatic hydrocarbons on High-Volume filters, based on simple colour intensity measurements. Thus, the initially visual grading of the colour intensity was followed by the more accurate instrumental determination of the optical density at the optimum wavelength which was established at 302 nm (Tables 38A-48D).

The optical density values of filter extracts are presently being evaluated statistically for their significance and usefulness in a future analytical method for PAH compounds in general, and for BaP specifically (16).

It should be noted that apart from possibly becoming the basis for a new method, the colour intensities of the filter extracts provided a cross-check on the BaP and BkF concentrations values in the present survey. On several occasions, analytical or calculation errors were spotted in this work by simply comparing the BaP and BkF values with the corresponding colour intensities. The fact that checking for such errors was possible by simply determining the colour intensities of the filter extracts, seemed to confirm the inherent potential for such a method.

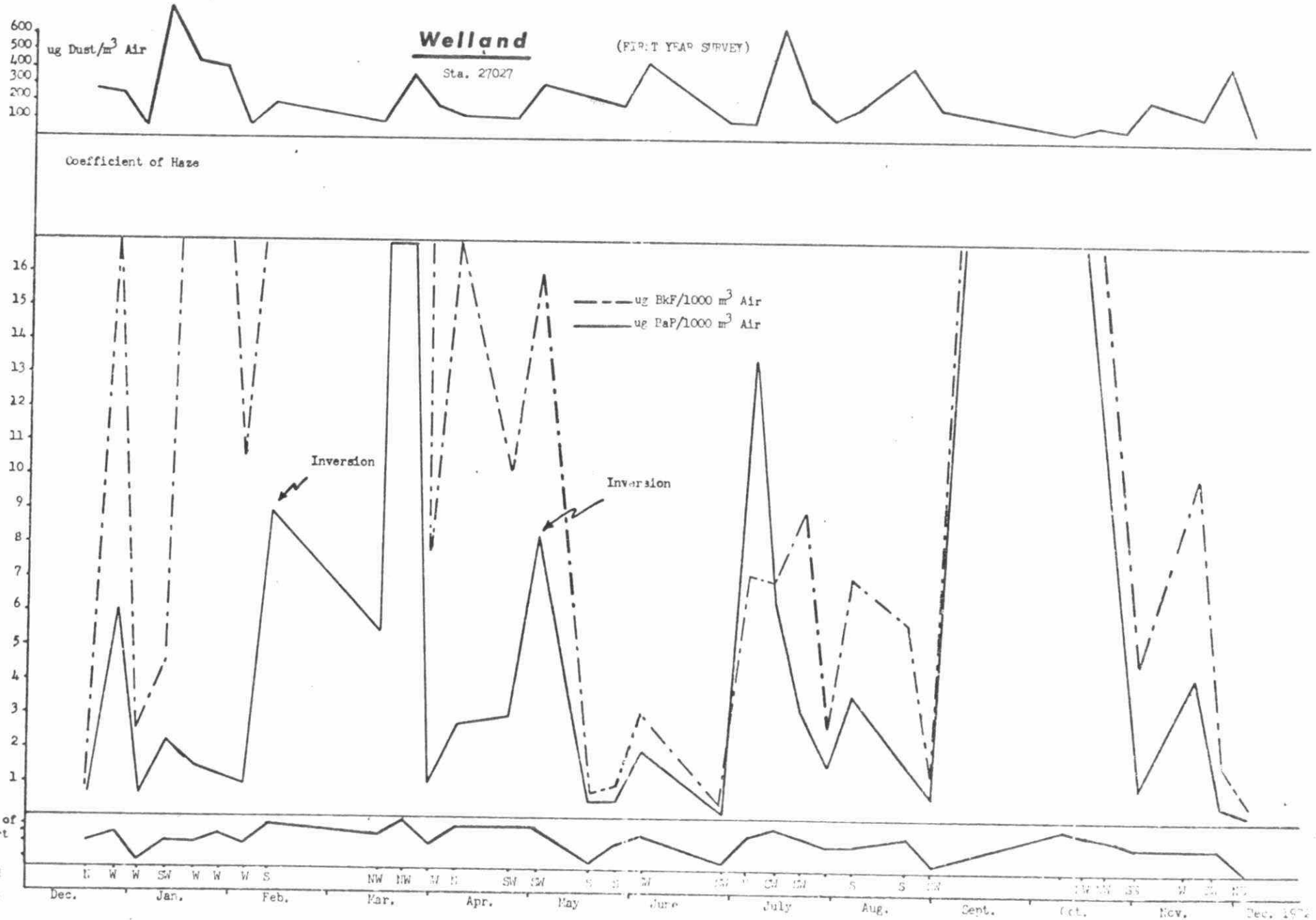

Welland
Sta. 27027
(FIRST YEAR SURVEY)
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
Inversion
Inversion
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1971
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec. 1972

FIGURE 19-A

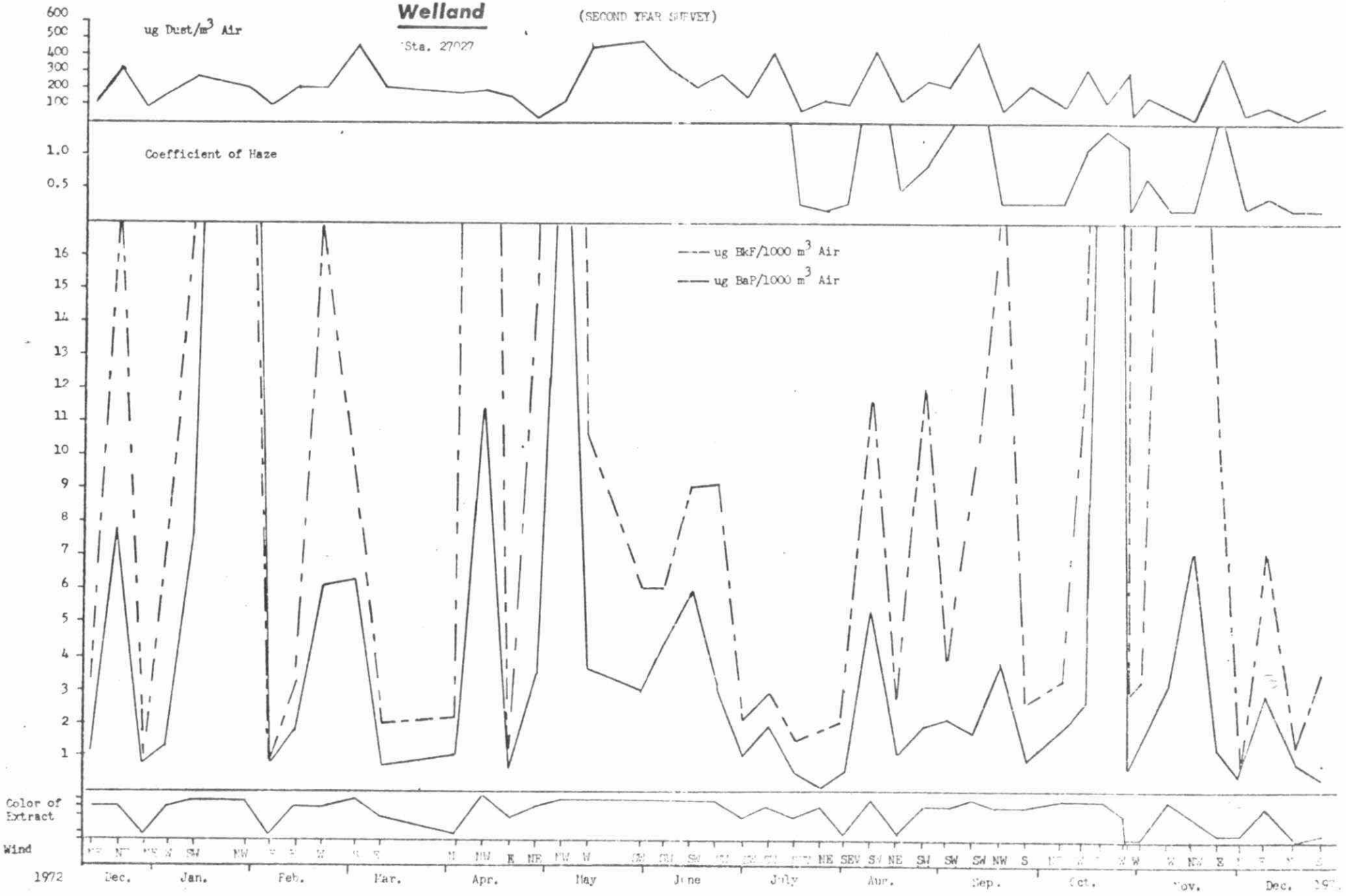

Welland
(SECOND YEAR SURVEY)
Sta. 27027
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1972
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.

FIGURE 19-B

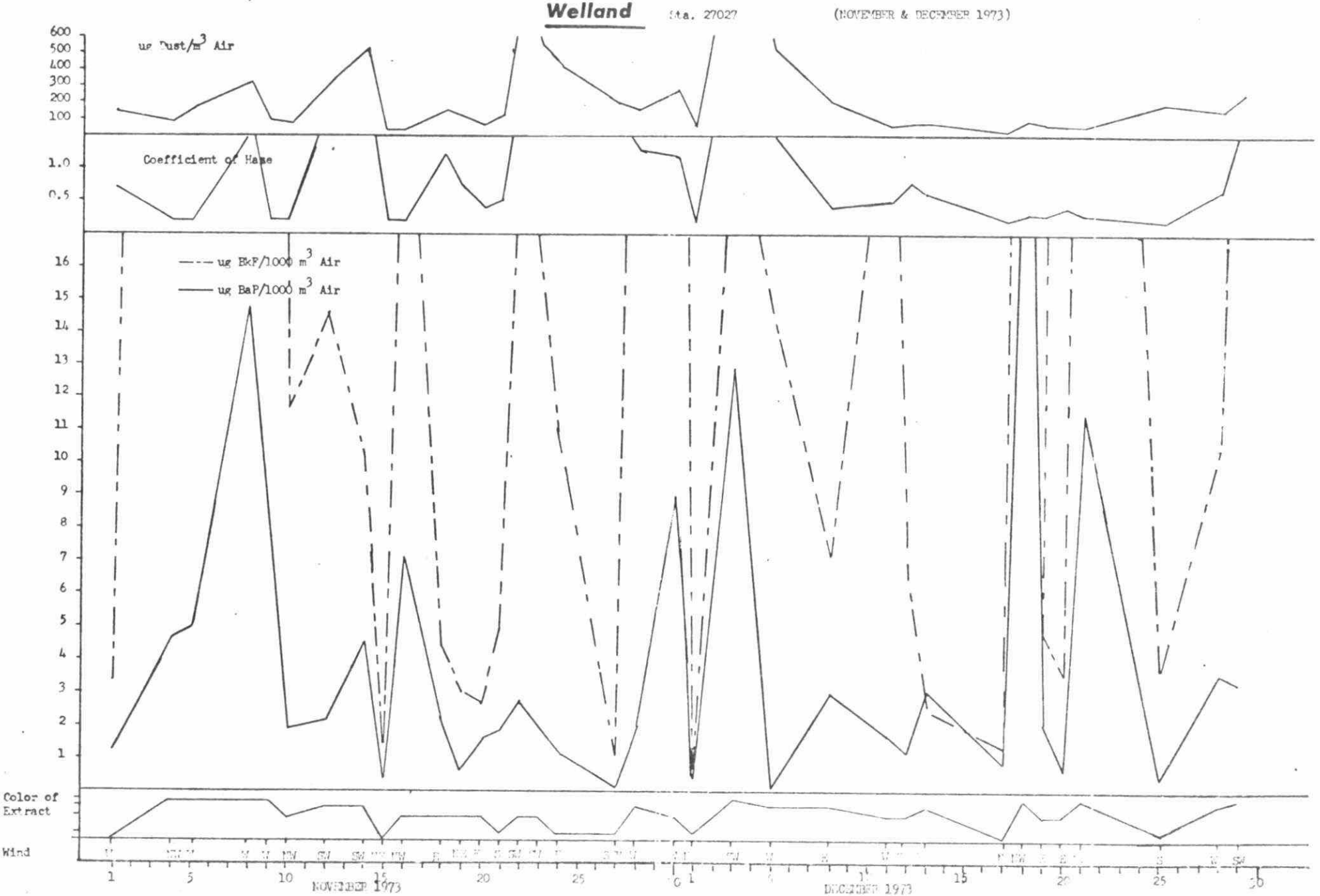

Welland
Sta. 27027
(NOVEMBER & DECEMBER 1973)
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1
5
10
15
20
25
NOVEMBER 1973
1
5
10
15
20
25
30
DECEMBER 1973

FIGURE 19-C

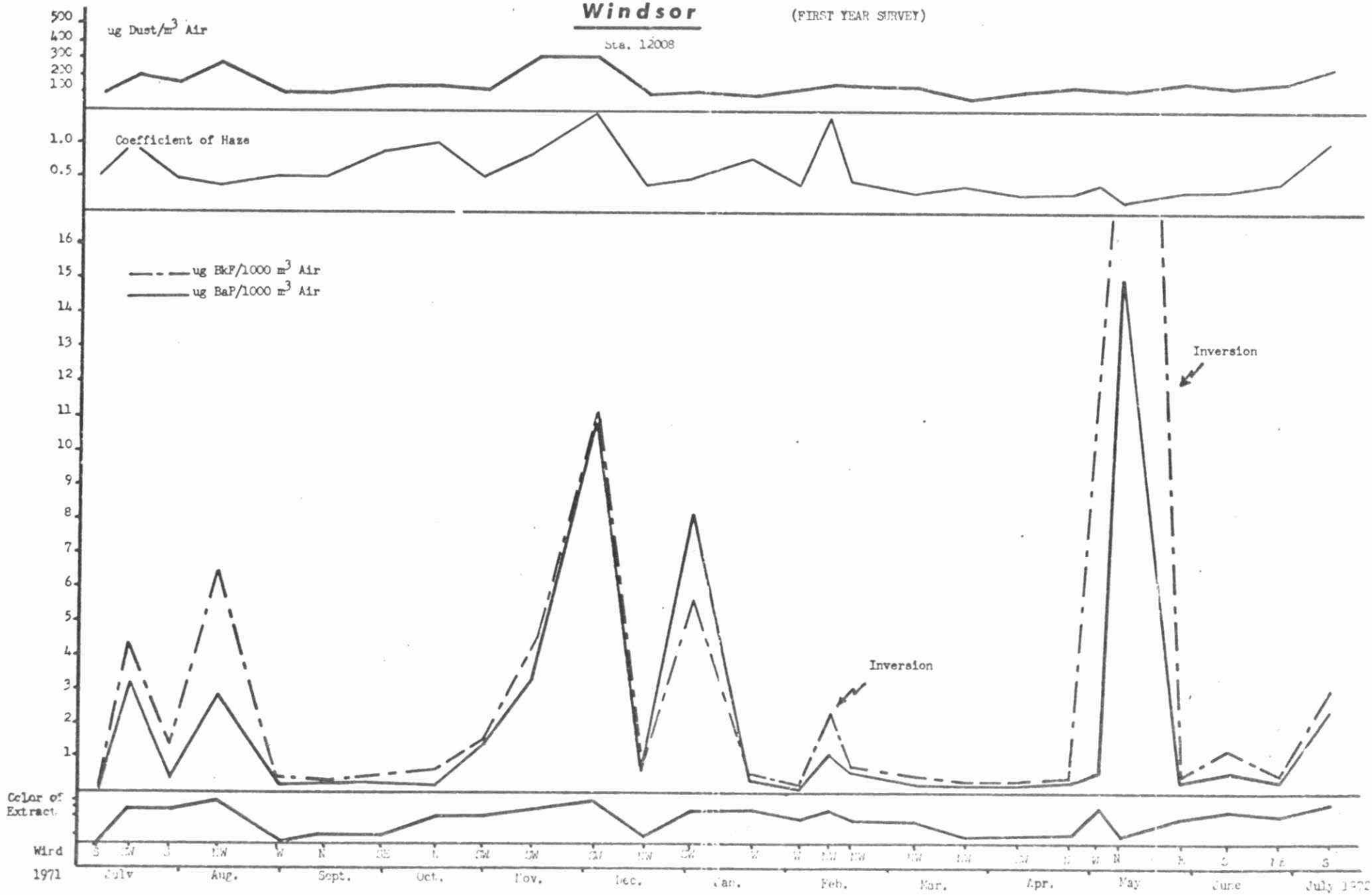

Windsor
(FIRST YEAR SURVEY)
Sta. 12008
ug Dust/m3 Air
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Inversion
Inversion
Color of Extract
Wind
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 20-A

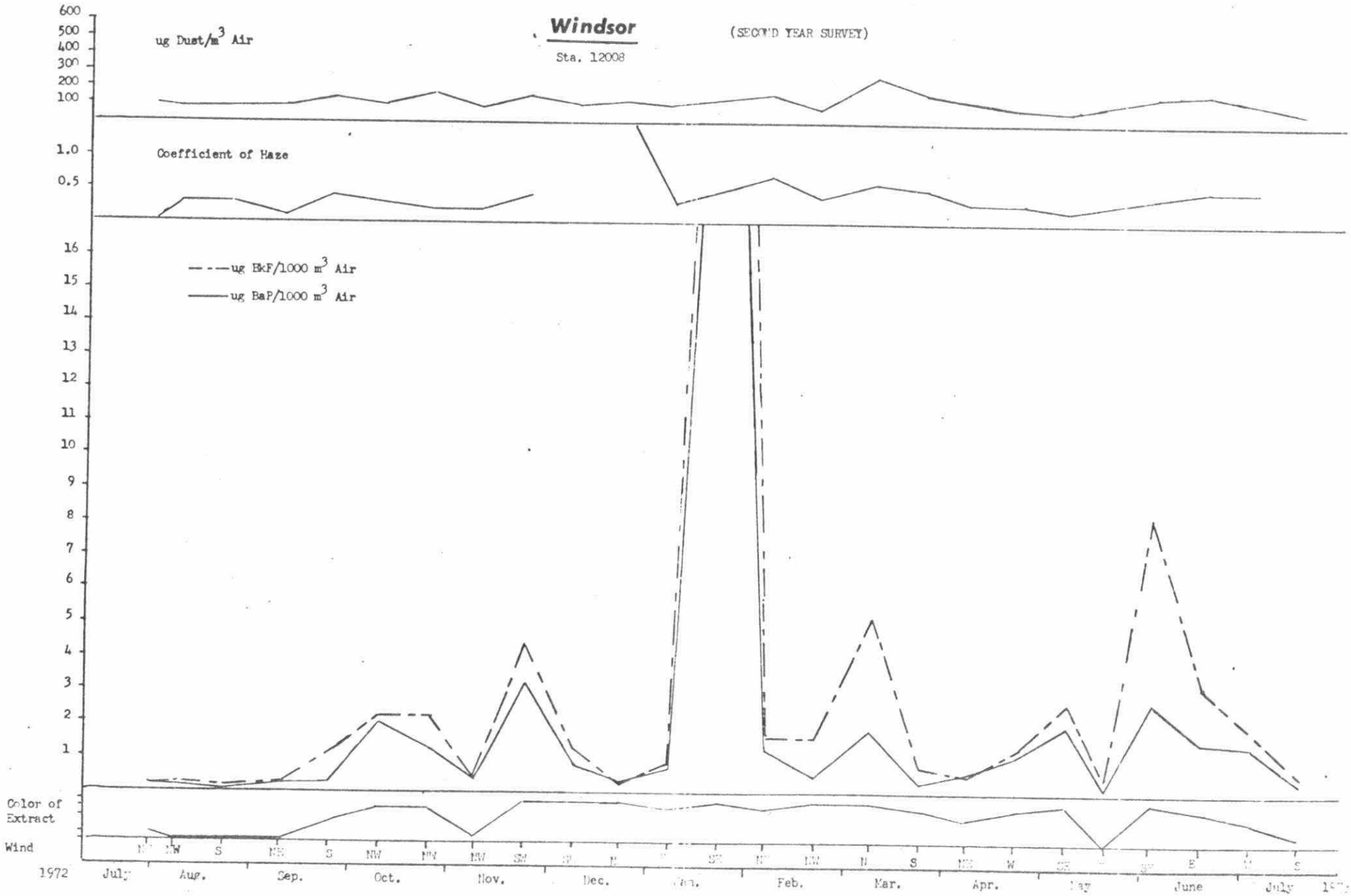

Windsor
Sta. 12008
(SECOND YEAR SURVEY)
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July

FIGURE 20-B

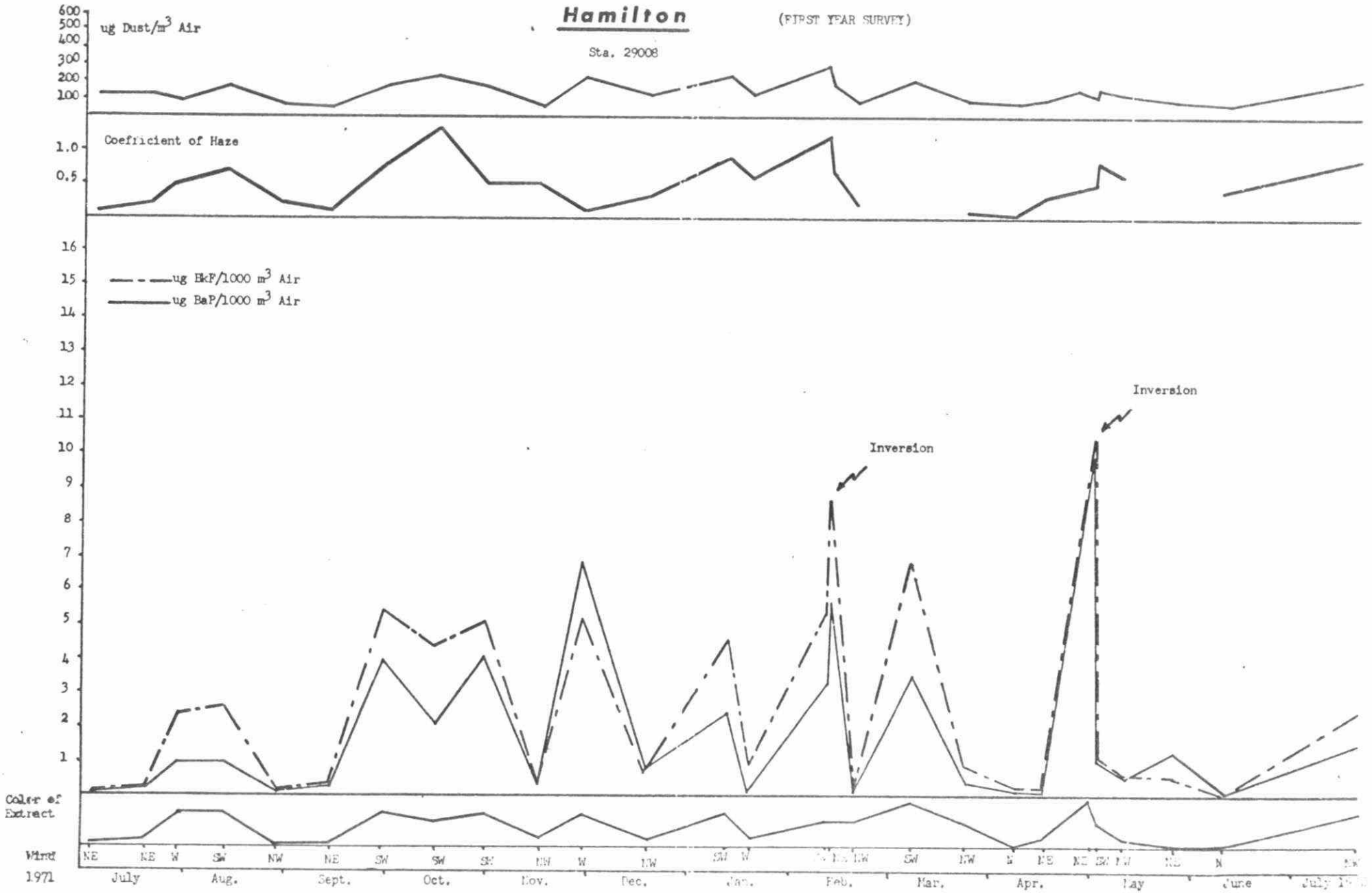

Hamilton
(FIRST YEAR SURVEY)
Sta. 29008
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Inversion
Inversion
Color of Extract
Wind
1971
NE NE W SW NW NE SW SW SW NW W NW SW W NW SW NW N
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June

FIGURE 21-A

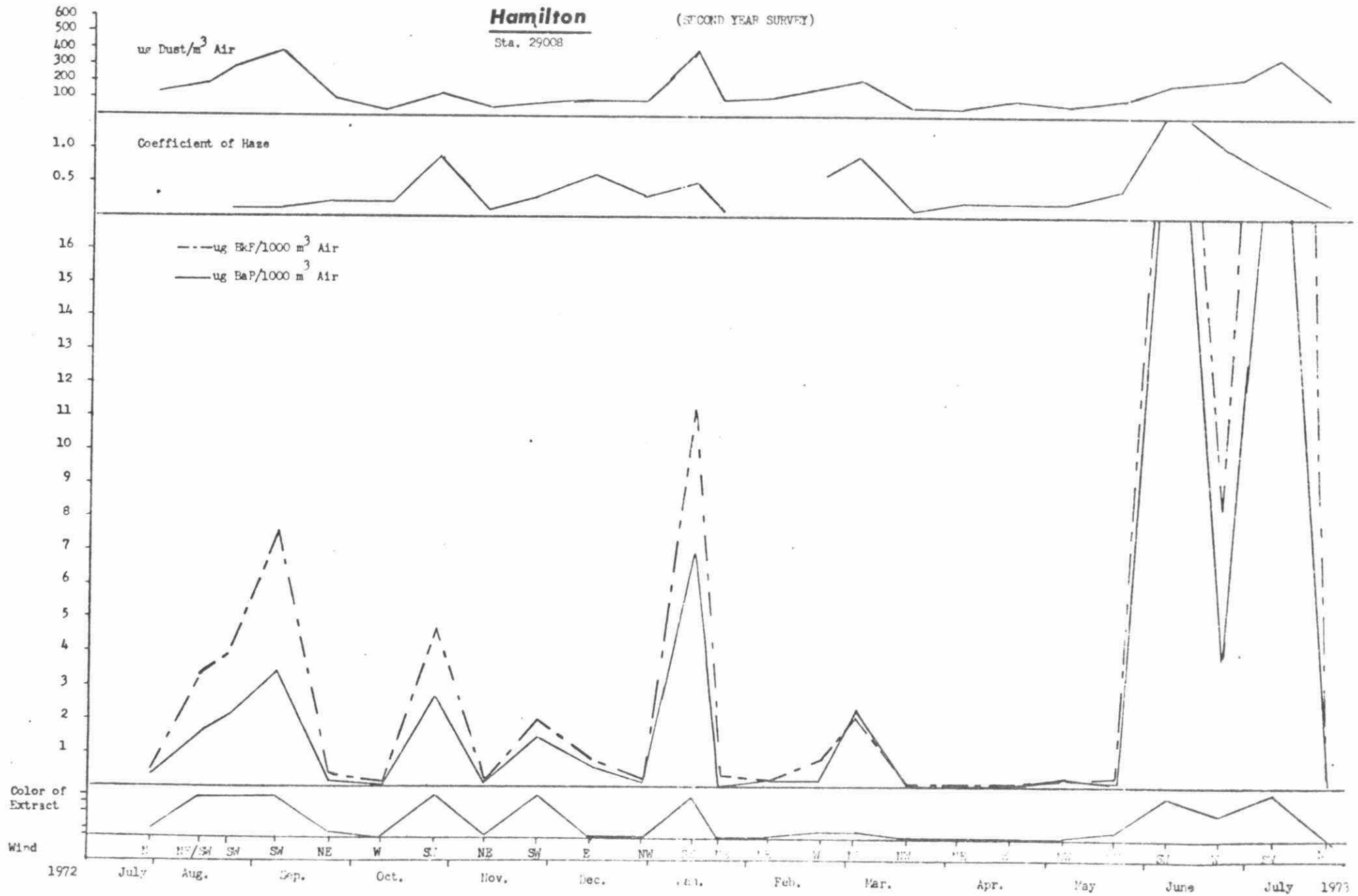

Hamilton
(SECOND YEAR SURVEY)
Sta. 29008
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
---ug BkF/1000 m3 Air
——ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
N
NE/SW
SW
SW
NE
W
SW
NE
SW
E
NW
SW
SW
SW
W
NW
NW
SW
W
SW
N
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
1973

FIGURE 21-B

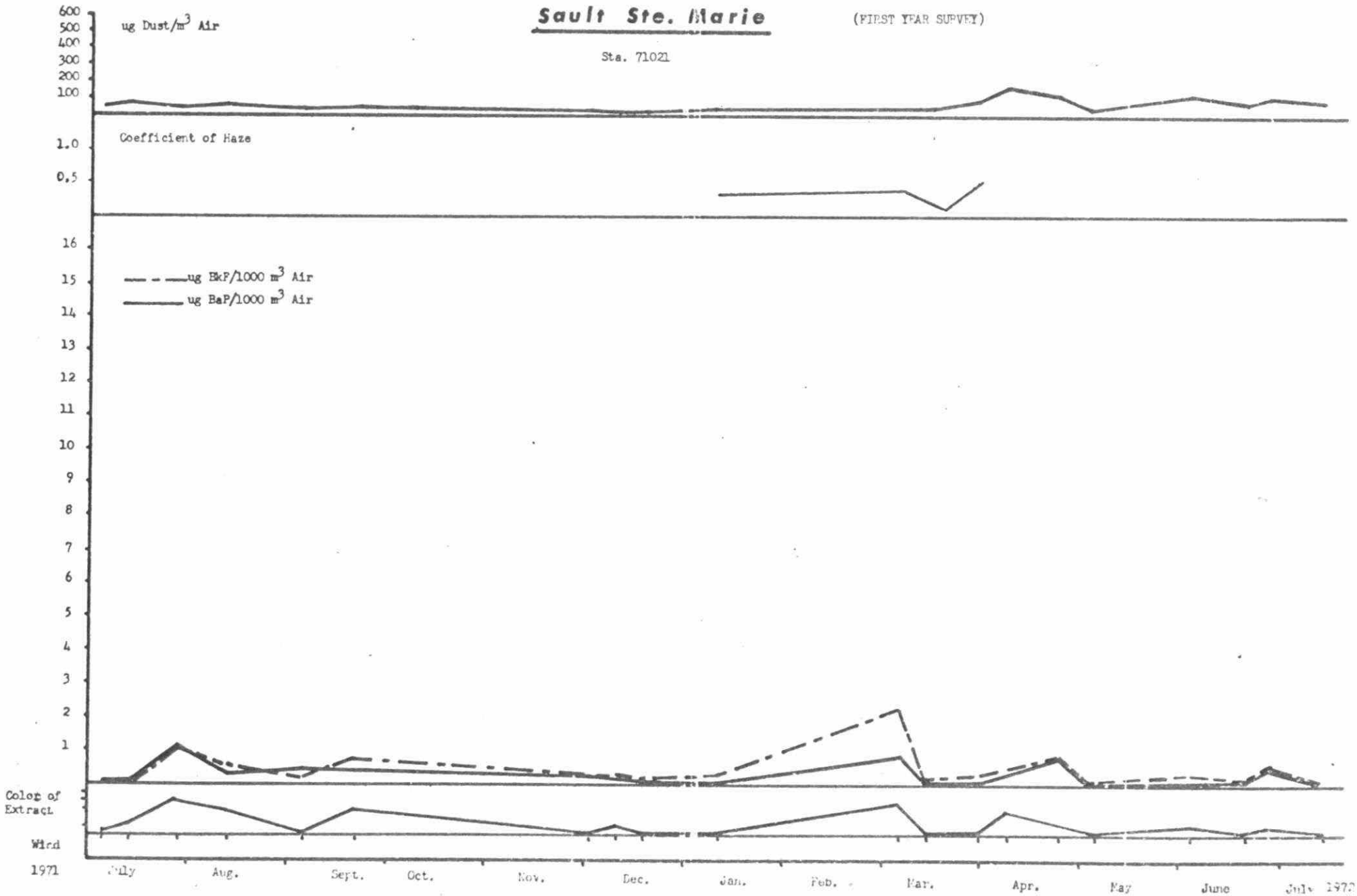

Sault Ste. Marie
(FIRST YEAR SURVEY)
Sta. 71021
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 22-A

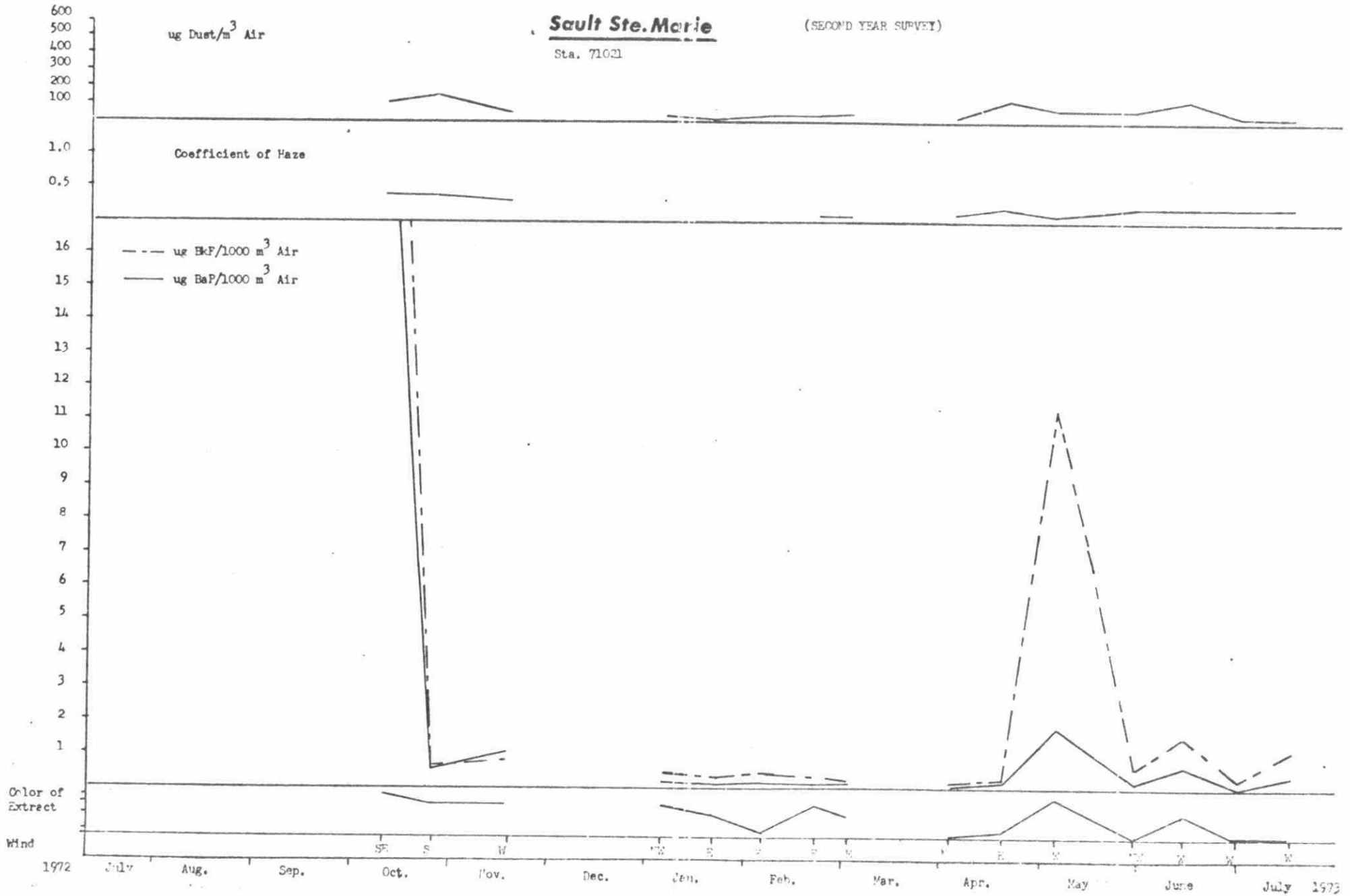

Sault Ste. Marie
(SECOND YEAR SURVEY)
Sta. 71021
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
1973

FIGURE 22-B

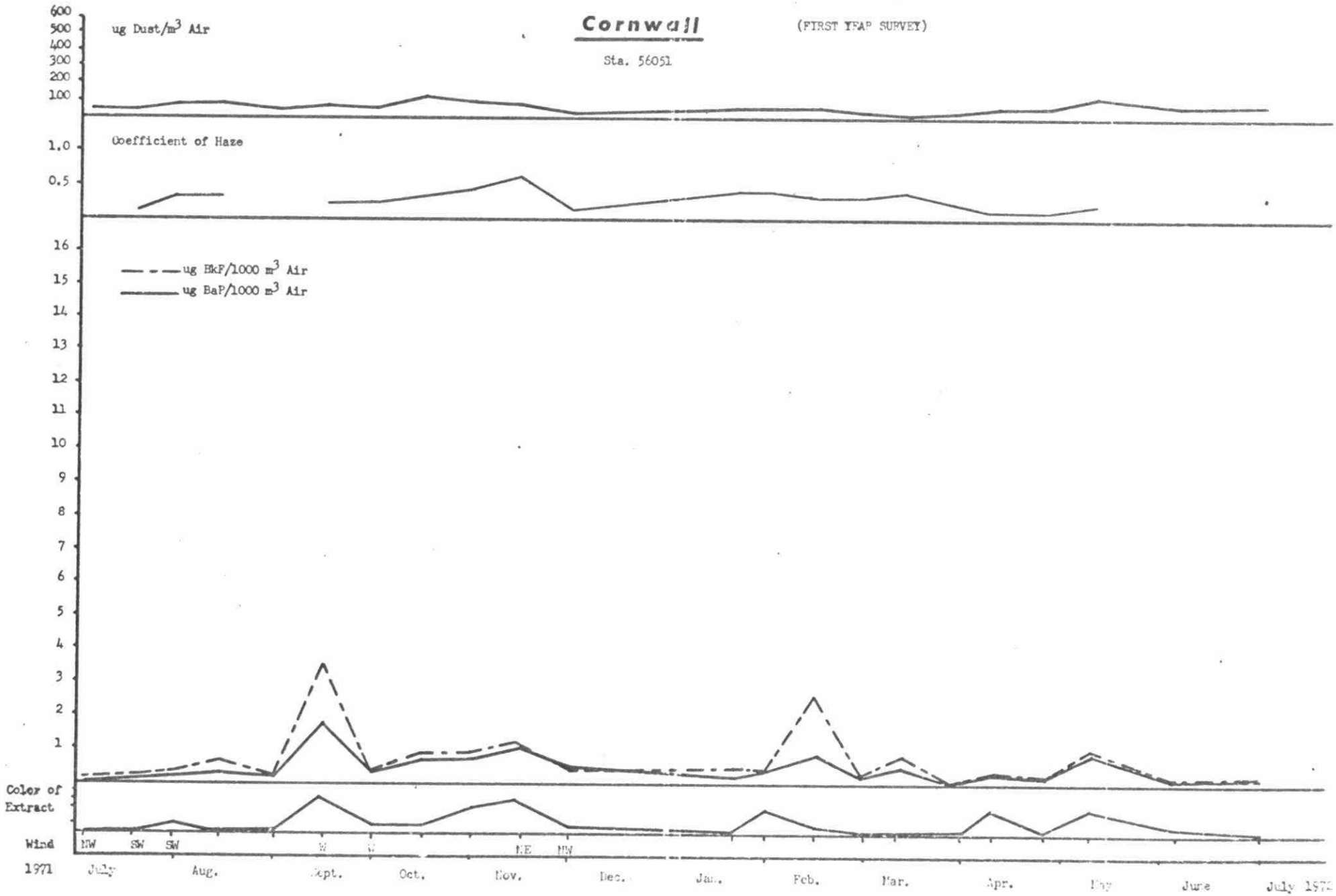

Cornwall
(FIRST YEAP SURVEY)
Sta. 56051
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
NW
SW
SW
W
W
NE
NW
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 23-A

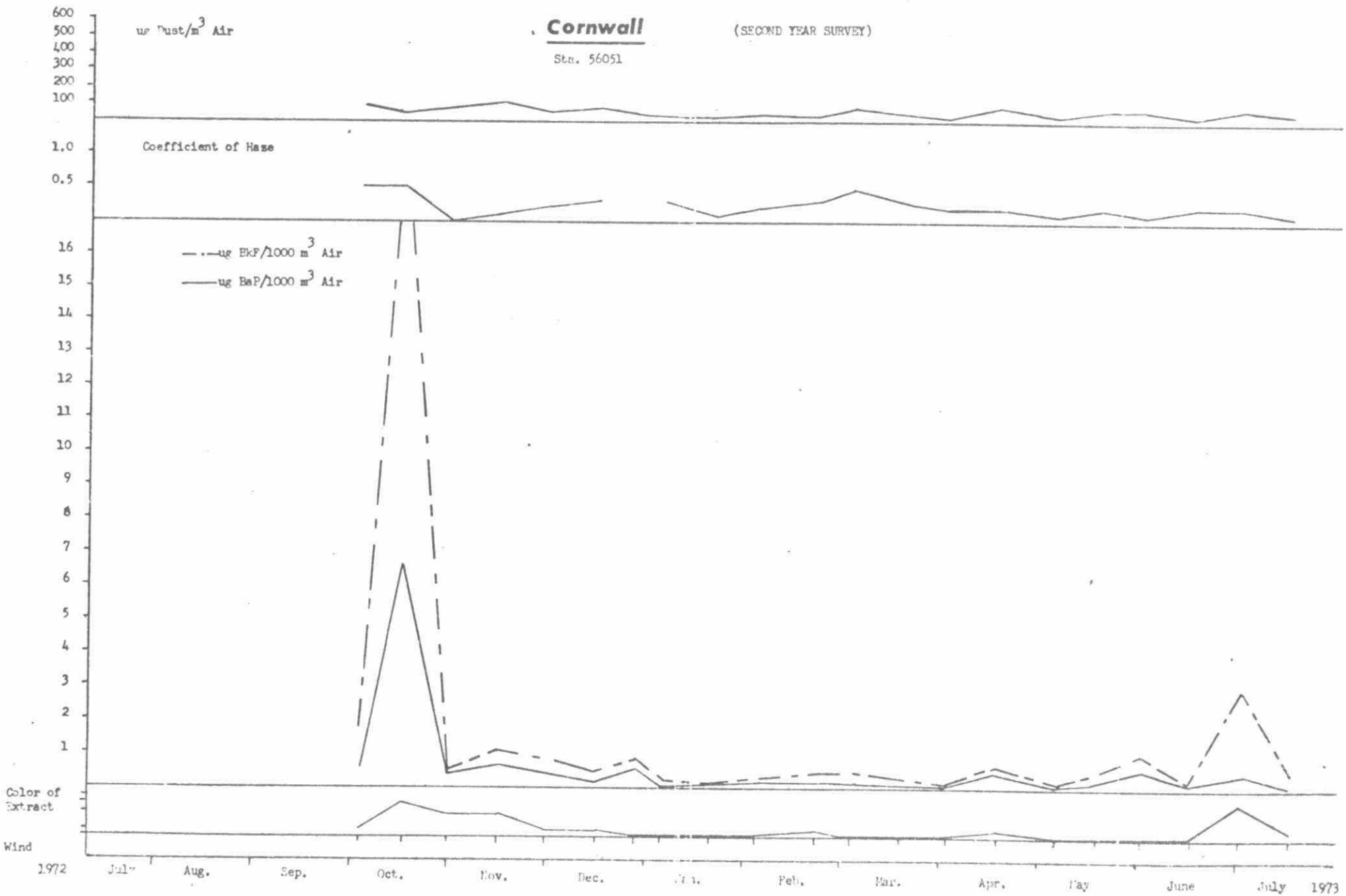

Cornwall
(SECOND YEAR SURVEY)
Sta. 56051
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
1973

FIGURE 23-B

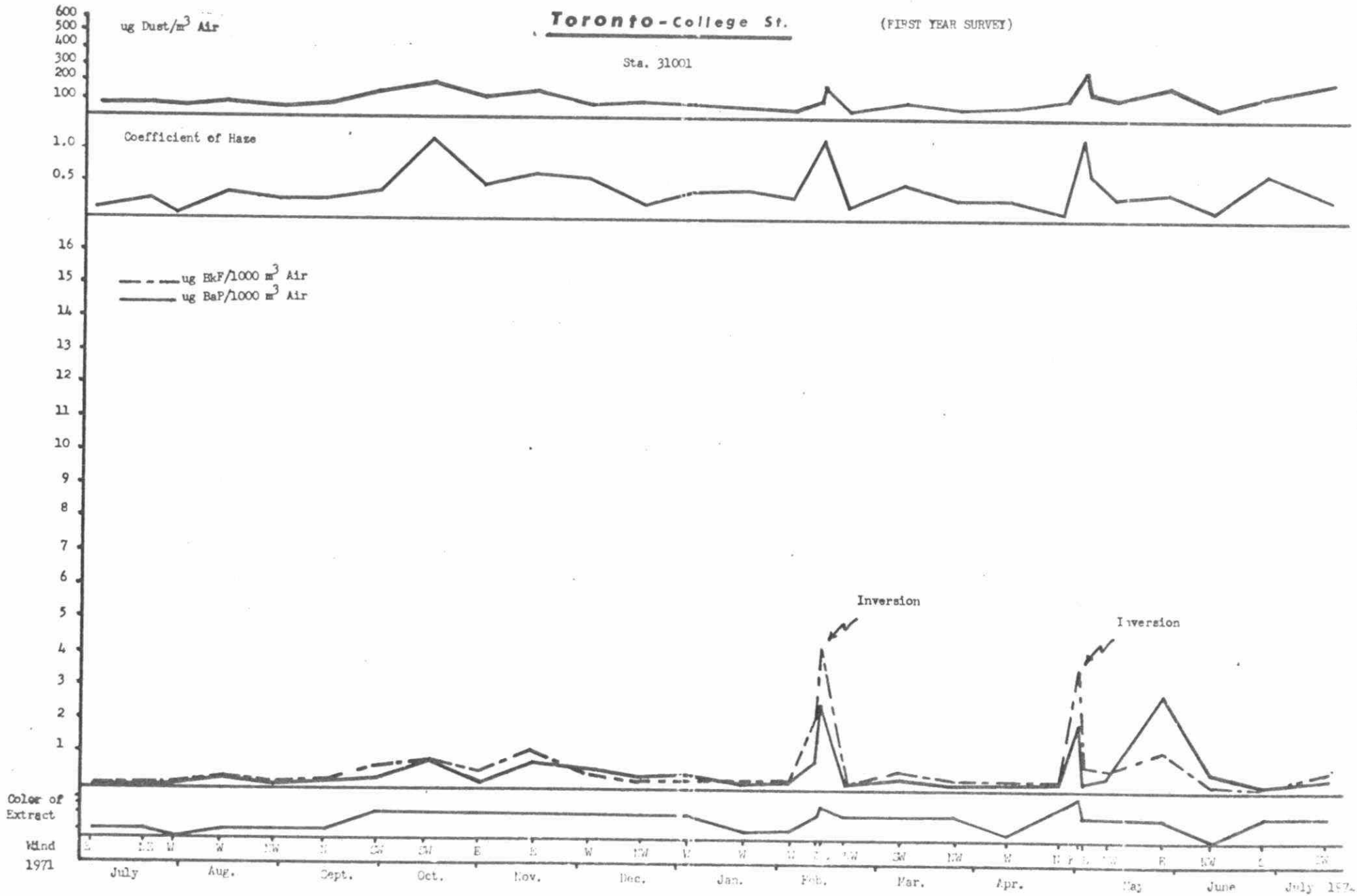

Toronto - College St.
(FIRST YEAR SURVEY)
Sta. 31001
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Inversion
Inversion
Color of Extract
Wind 1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 24-A

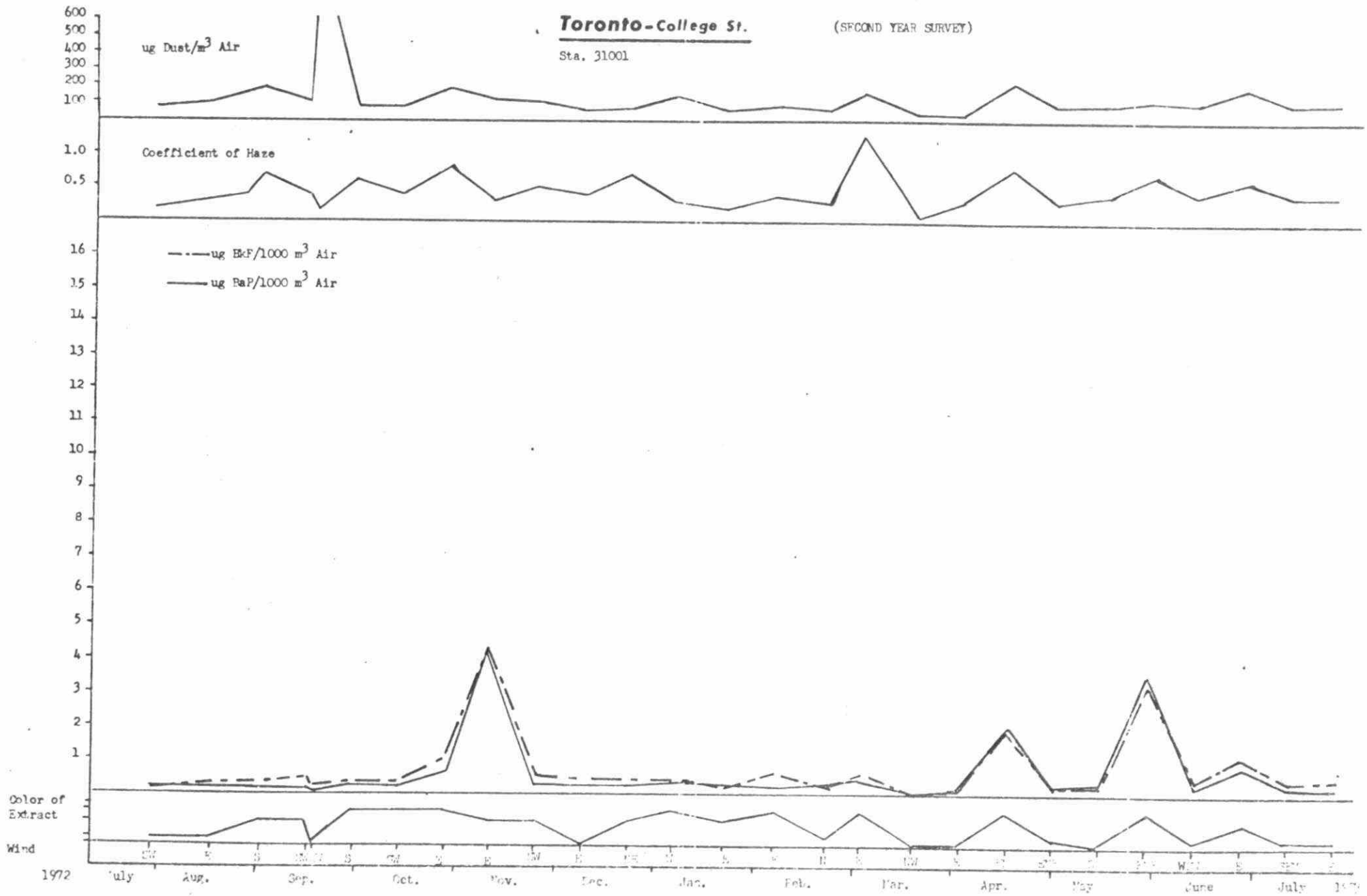

Toronto-College St.
(SECOND YEAR SURVEY)
Sta. 31001
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July

FIGURE 24-B

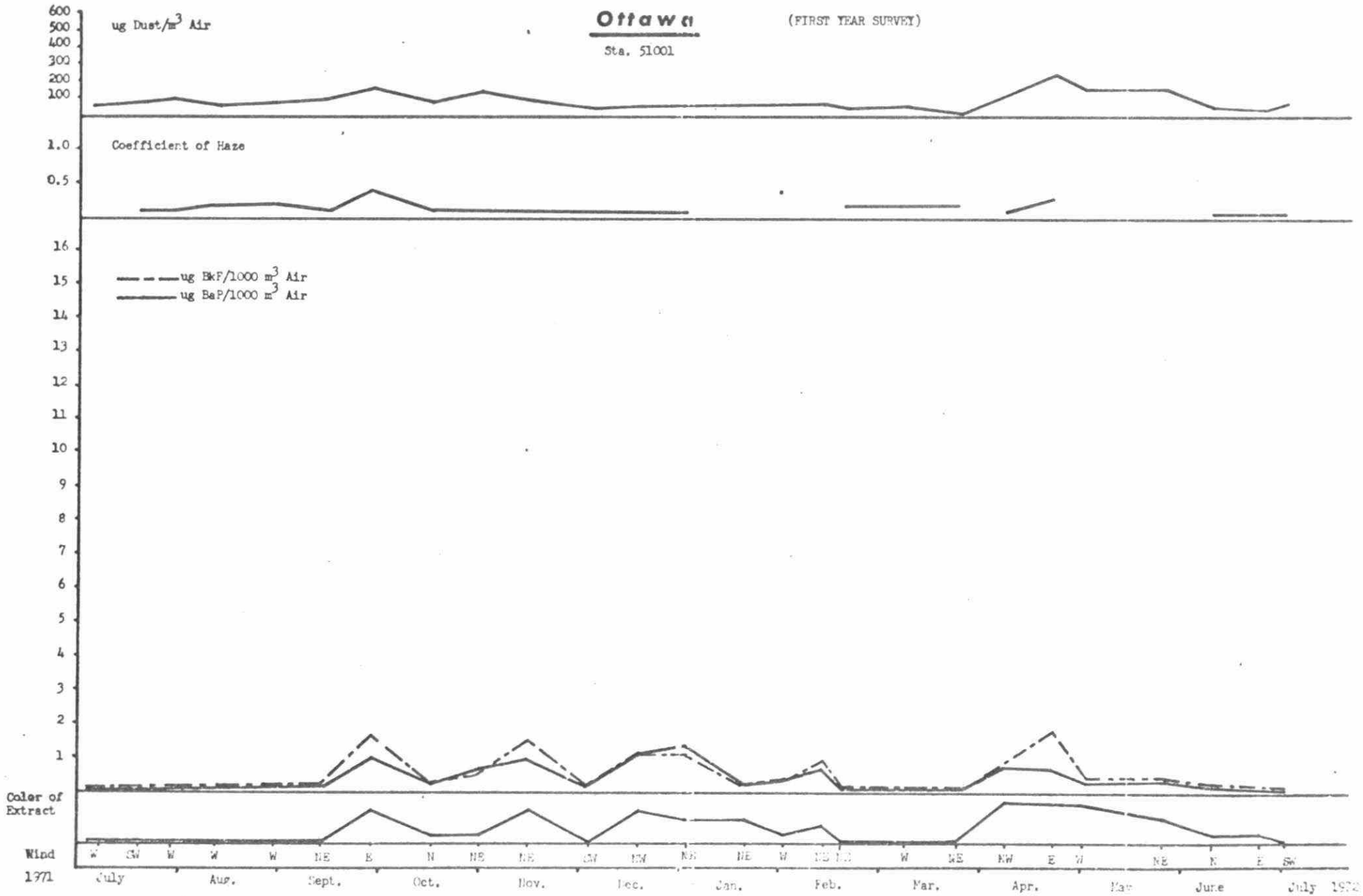

Ottawa
Sta. 51001
(FIRST YEAR SURVEY)
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
W CW W W W NE E N NE NE CW NW NE NE W NE NE W NE NW E W NE N E SW
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 25-A

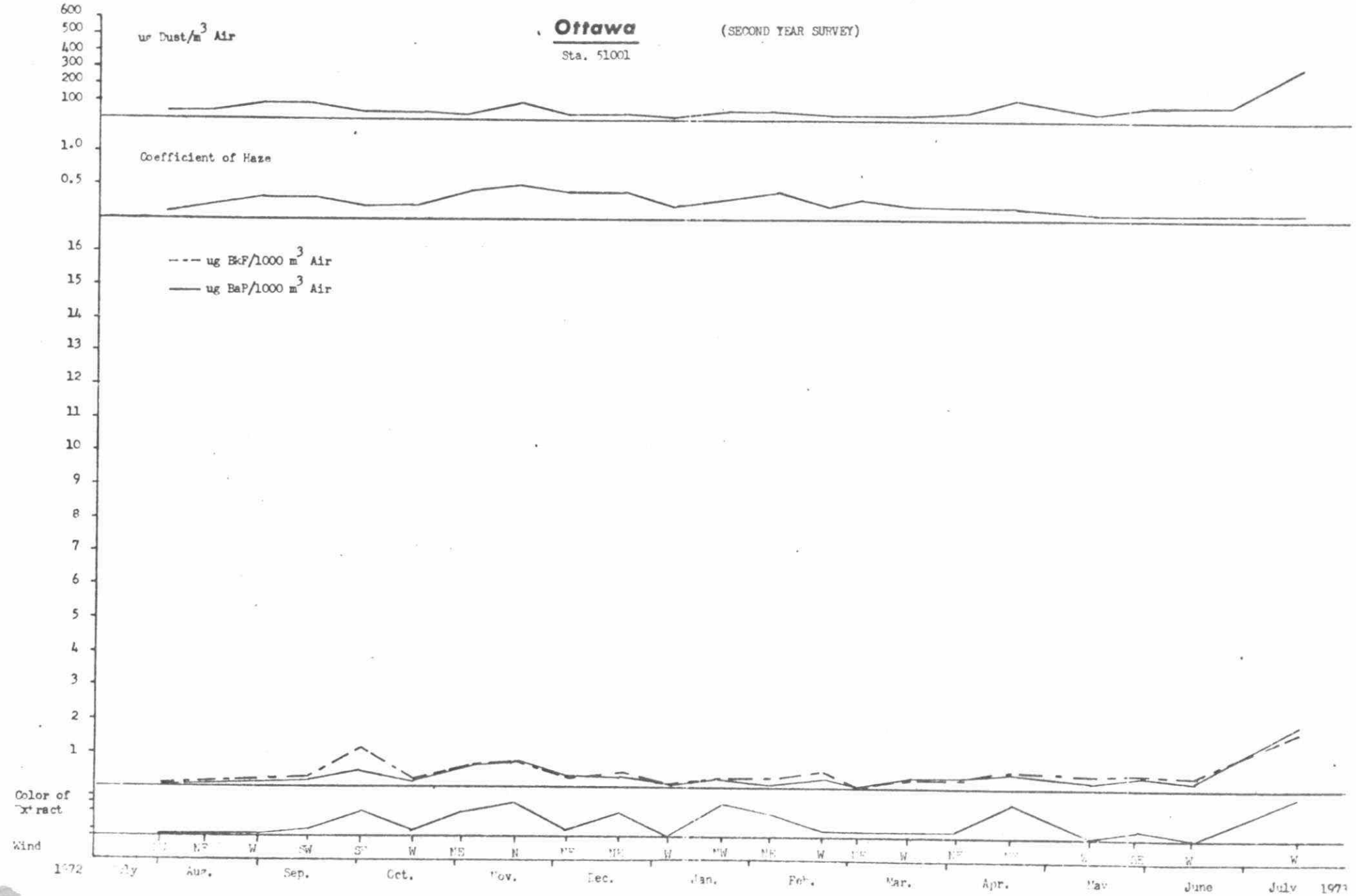

Ottawa
Sta. 51001
(SECOND YEAR SURVEY)
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
--- ug BkF/1000 m3 Air
—— ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
1973

FIGURE 25-B

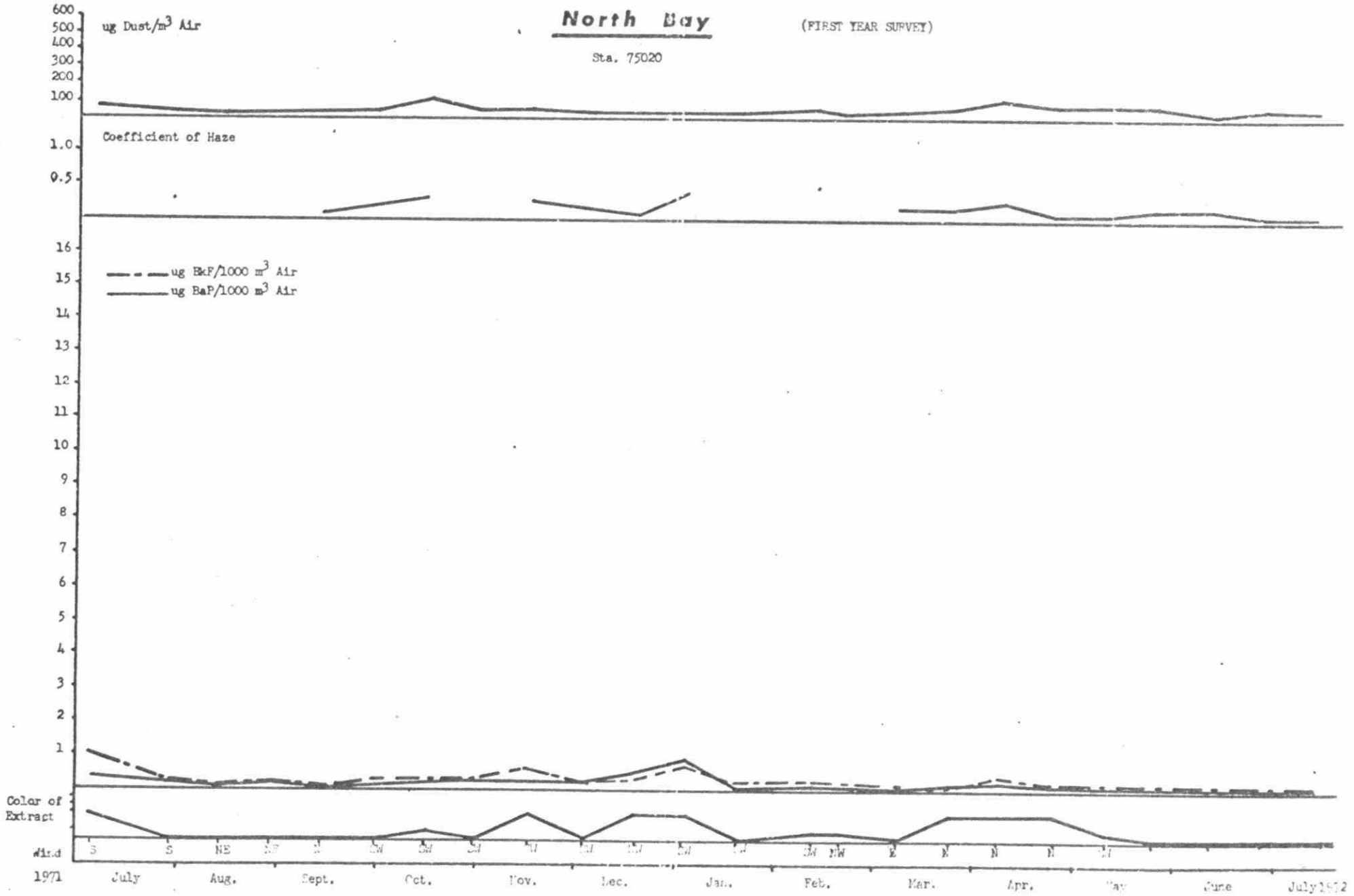

North Bay
(FIRST YEAR SURVEY)
Sta. 75020
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
S
S
NE
SW
SW
SW
W
SW
SW
SW
SW
NW
E
N
N
N
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 26-A

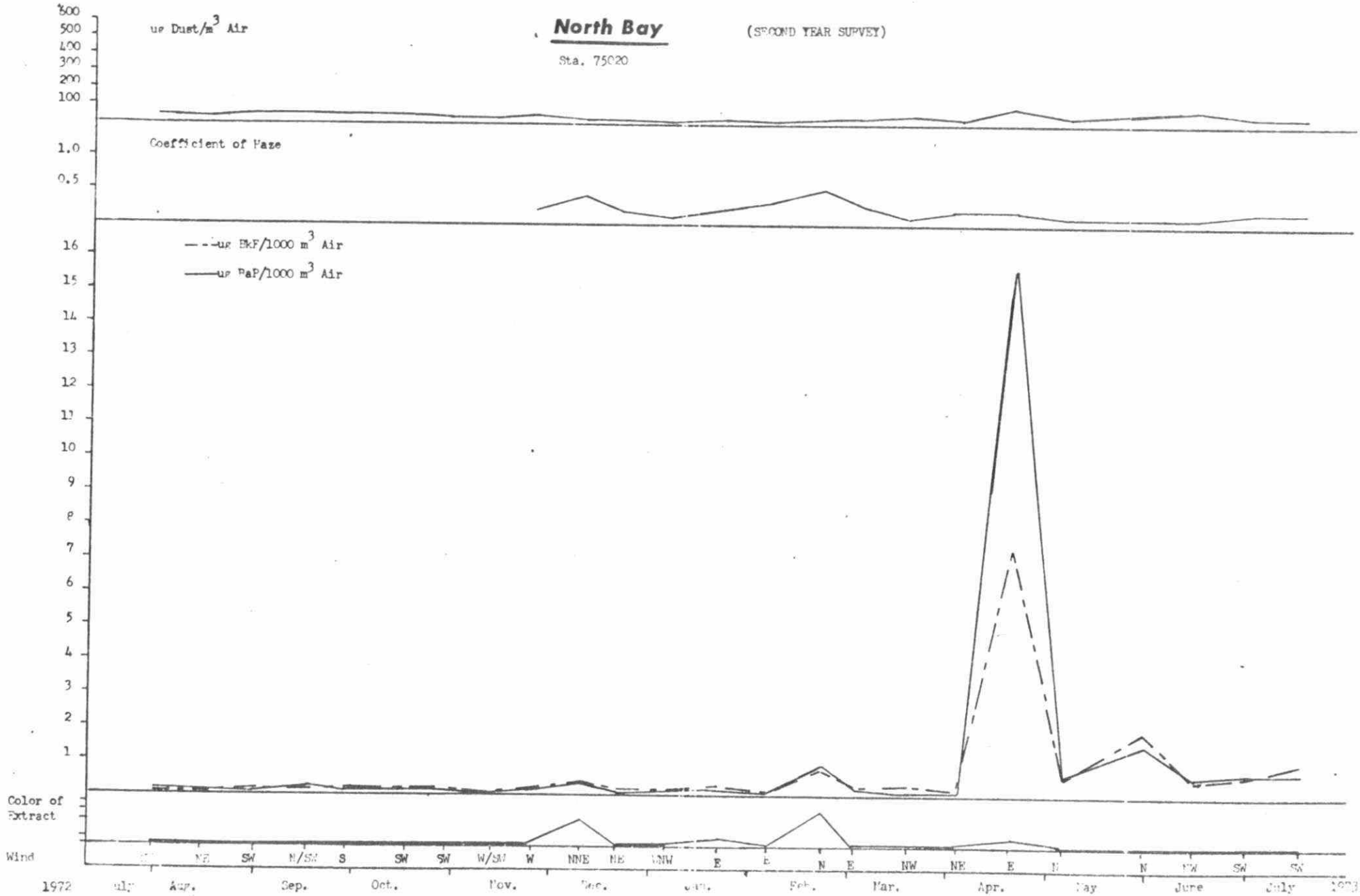

North Bay
(SECOND YEAR SURVEY)
Sta. 75020
ug Dust/m3 Air
Coefficient of Haze
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
Color of Extract
Wind
NE SW N/SW S SW SW W/SW W NNE NE NNW E E N E NW NE E N N NW SW SW
1972 July Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July 1973

FIGURE 26-B

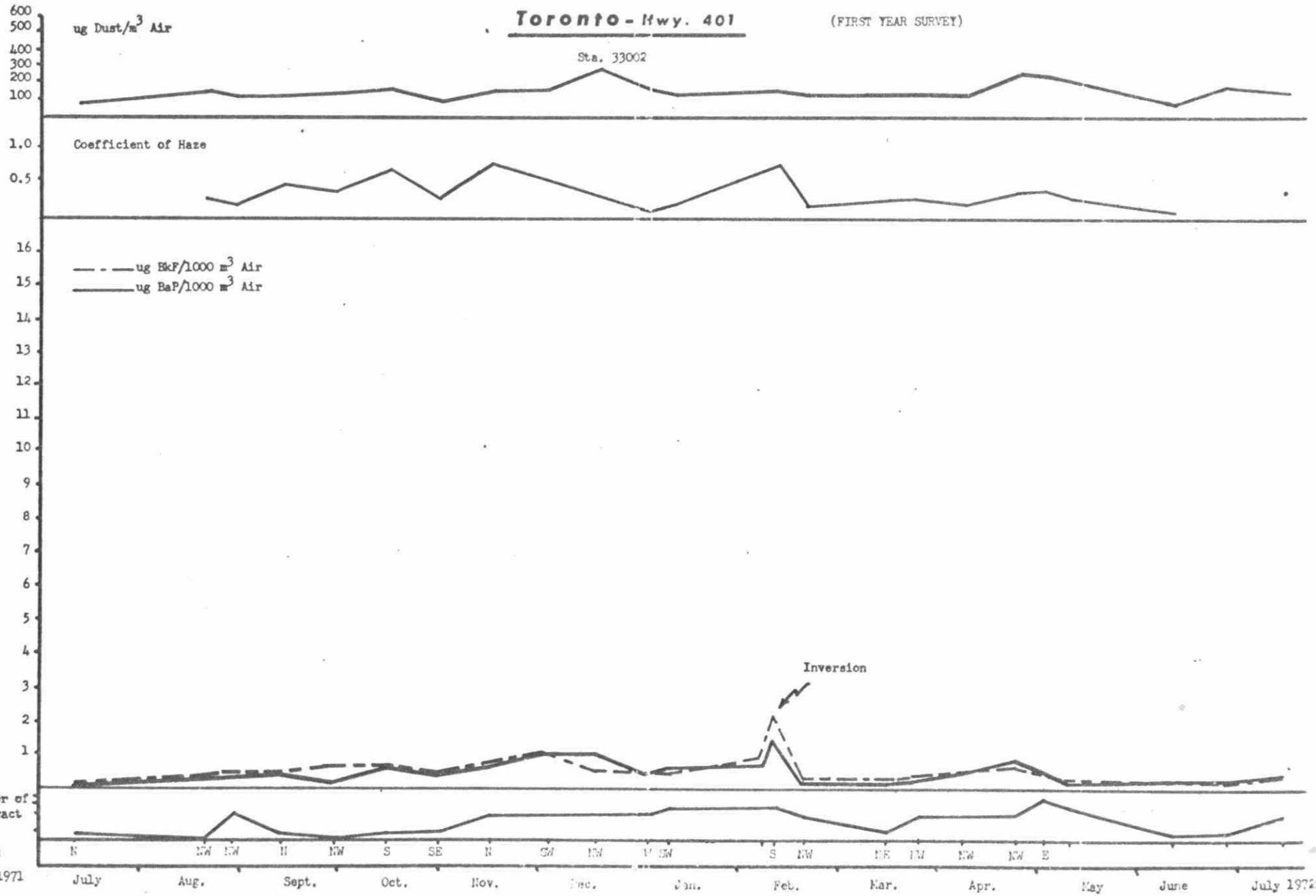

Toronto - Hwy. 401
(FIRST YEAR SURVEY)
ug Dust/m3 Air
Sta. 33002
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Inversion
Color of Extract
Wind
N
NW NW
N
NW
S
SE
N
SW
NW
W SW
S NW
NE NW
NW
NW E
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 27-A

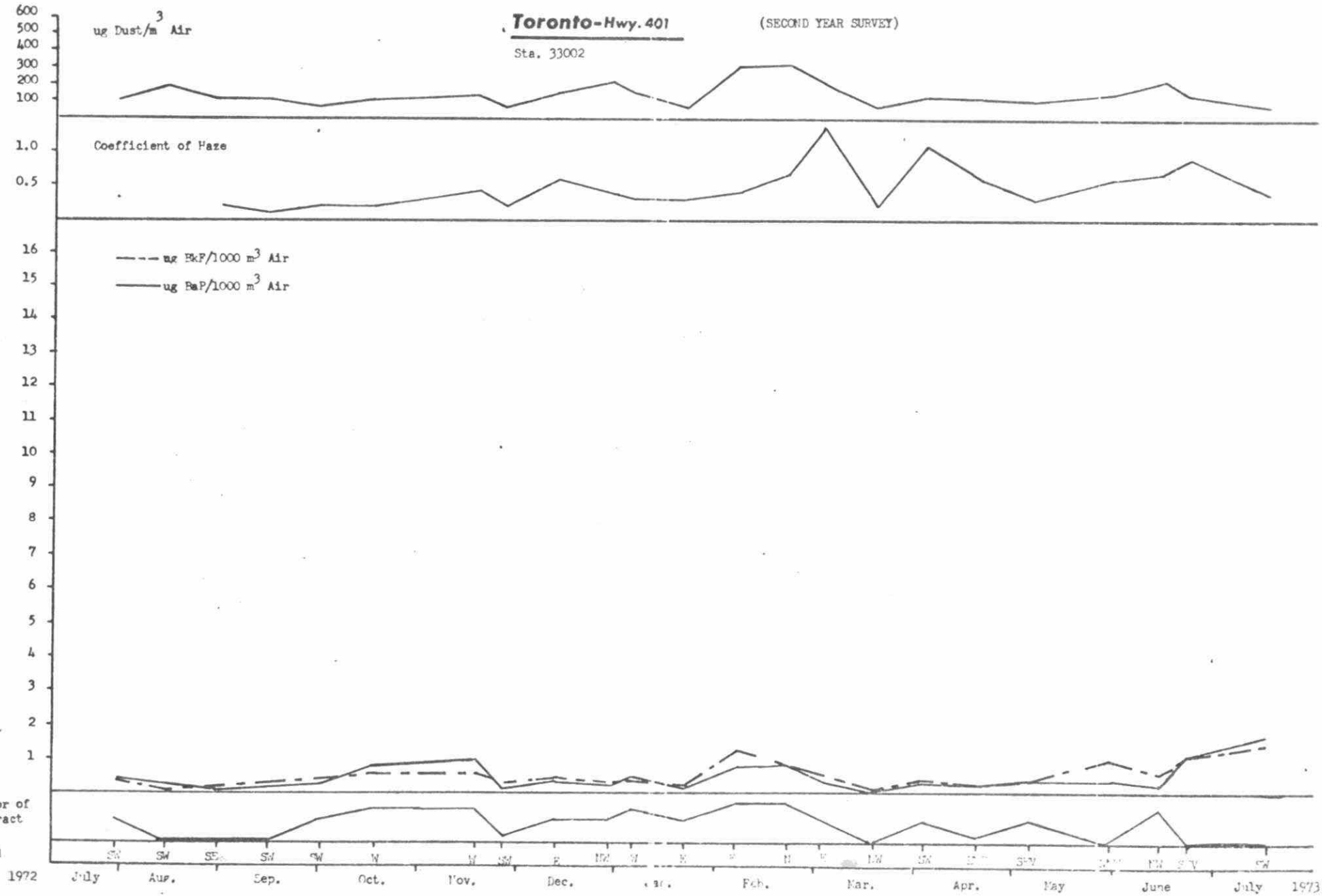

Toronto-Hwy. 401
(SECOND YEAR SURVEY)
Sta. 33002
ug Dust/m³ Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m³ Air
ug BaP/1000 m³ Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
SW SW SE SW SW W W SW E NW W N W W NW SW SW NW SW
1972 July Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July 1973

FIGURE 27-B

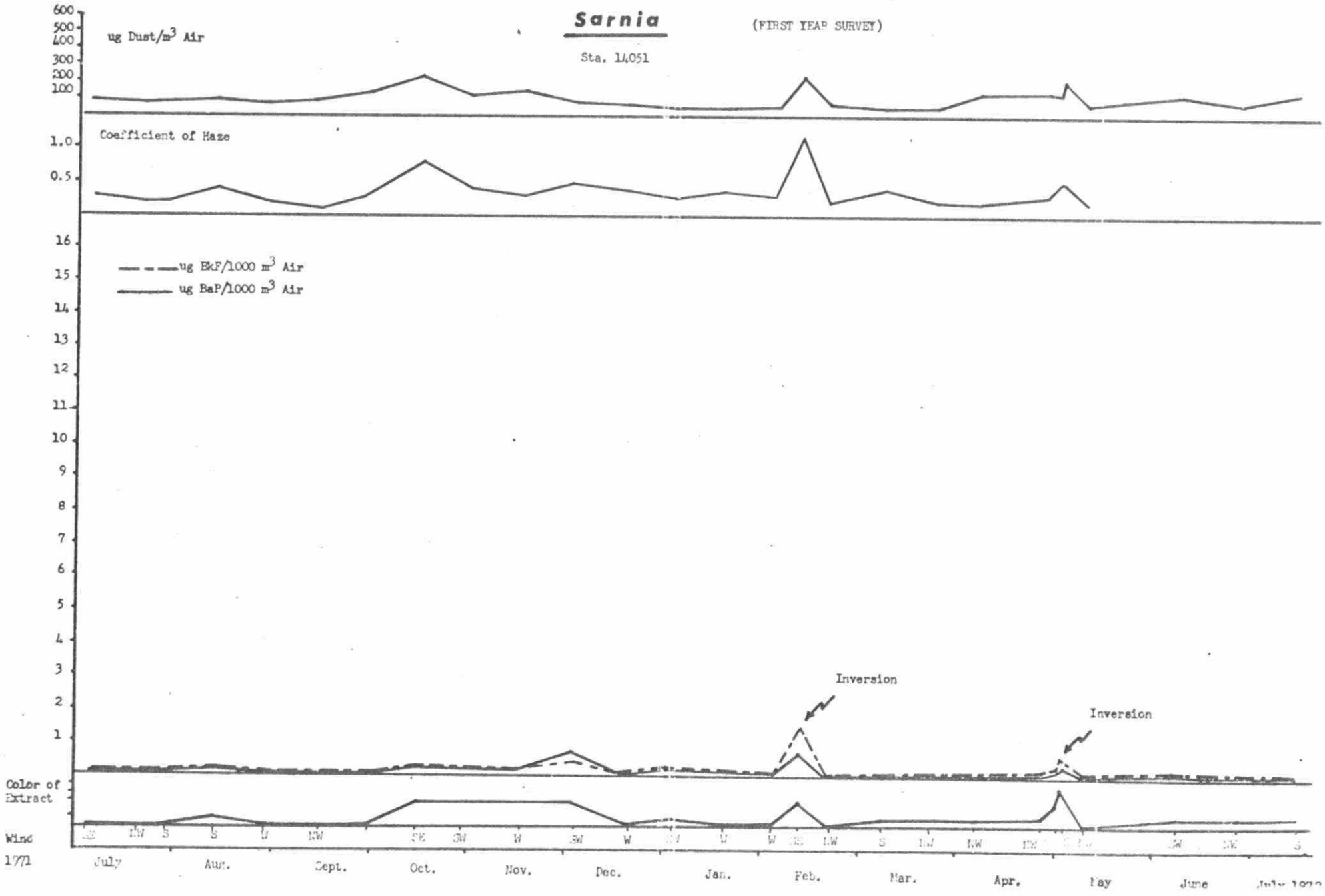

Sarnia
(FIRST YEAR SURVEY)
Sta. 14051
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug EkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Inversion
Inversion
Color of Extract
Wind
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June

FIGURE 28-A

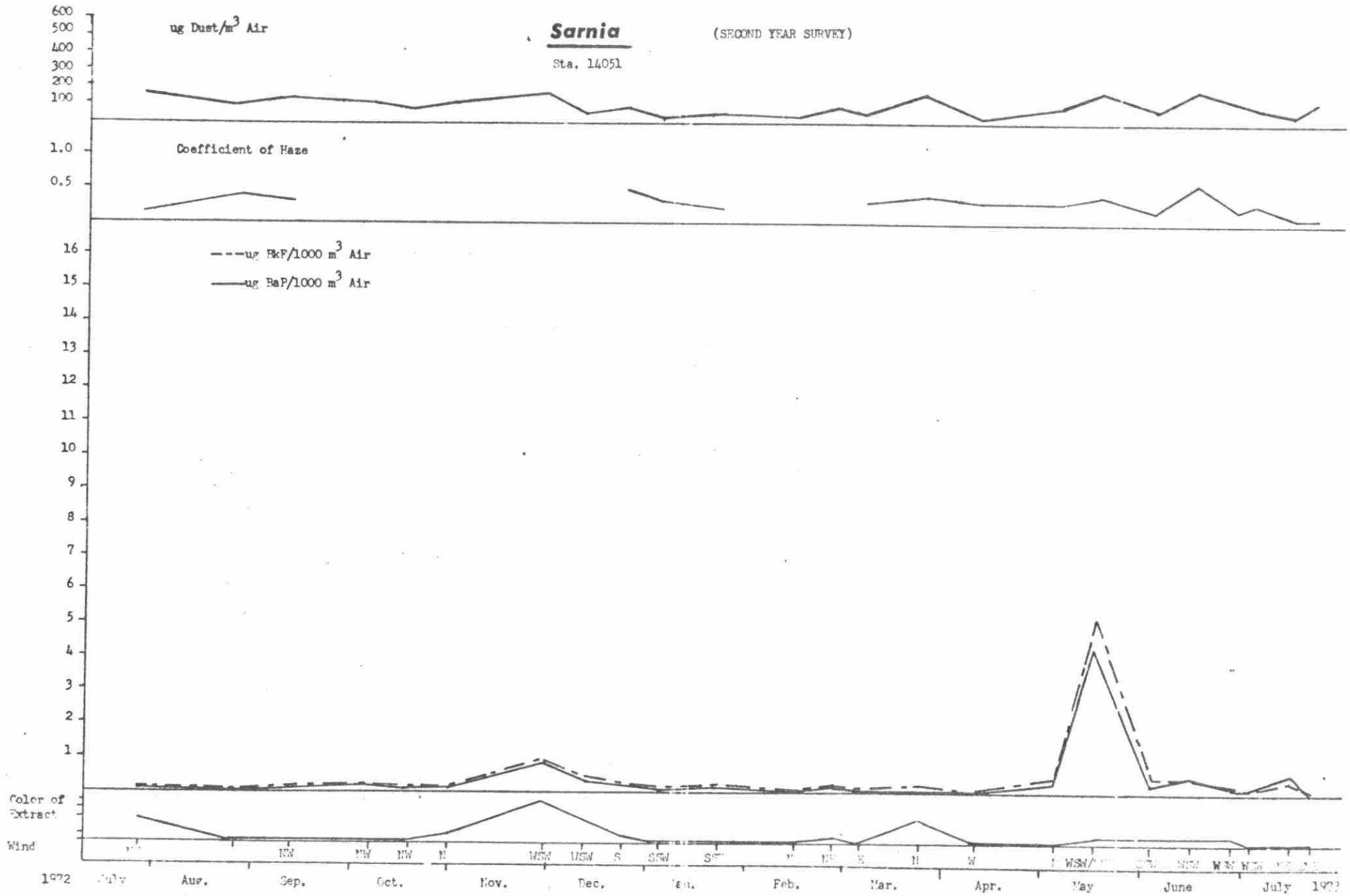

Sarnia
(SECOND YEAR SURVEY)
Sta. 14051
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
---ug BkF/1000 m3 Air
——ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
NW
NW
NW
N
WSW
WSW
S
SSW
N
N
W
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
1973

FIGURE 28-B

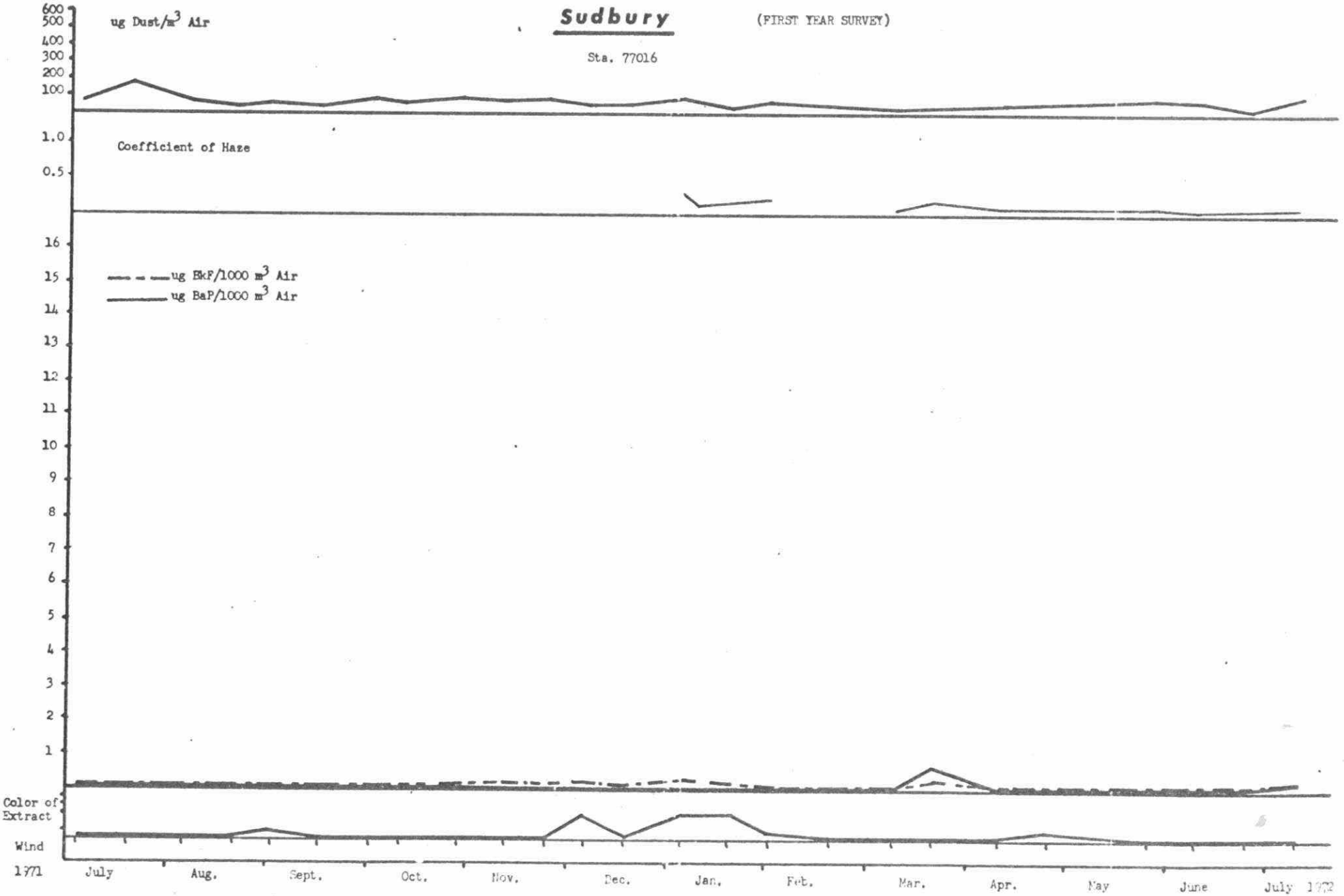

Sudbury
(FIRST YEAR SURVEY)
Sta. 77016
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1971
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July 1972

FIGURE 29-A

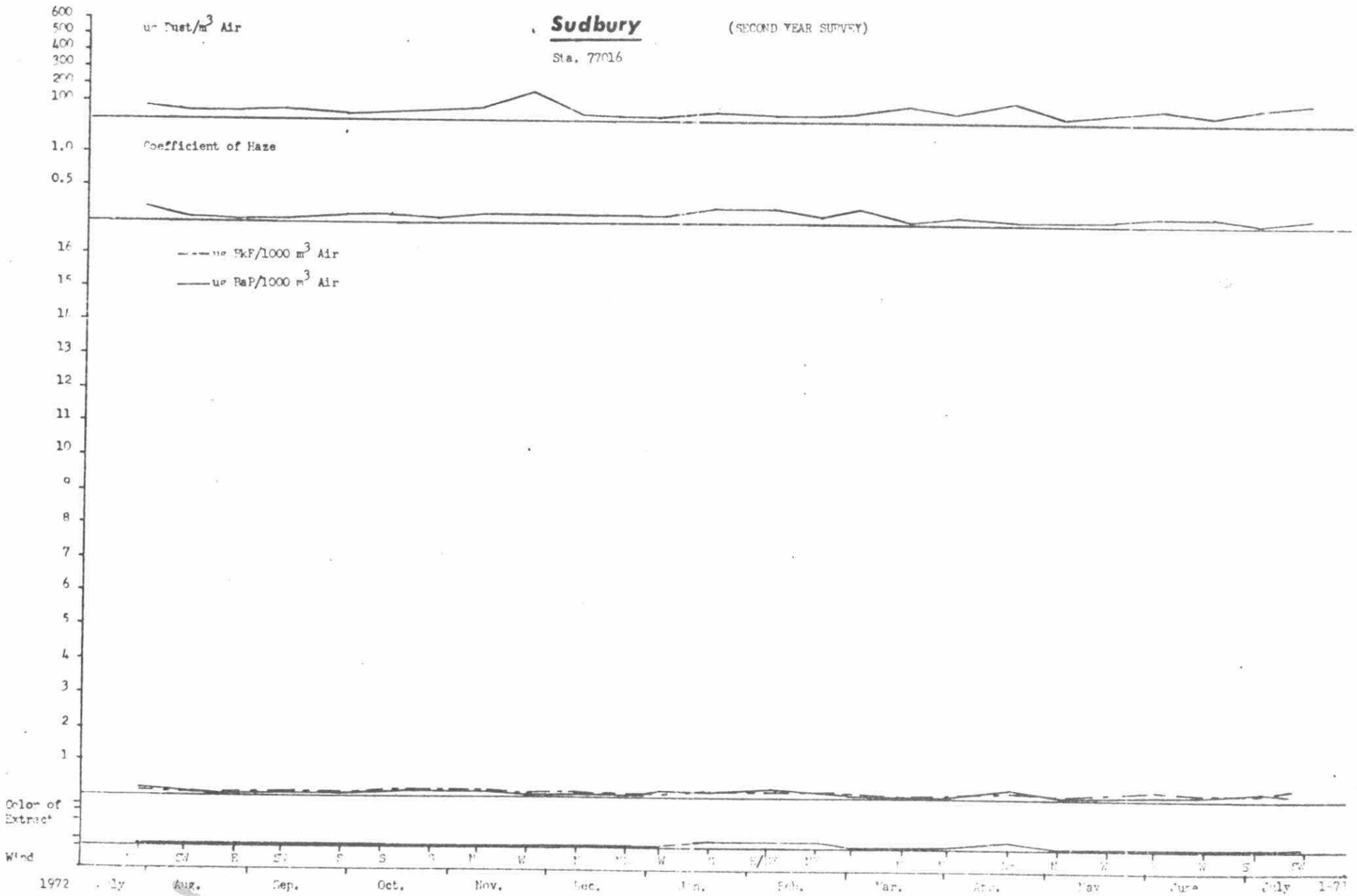

Sudbury
(SECOND YEAR SURVEY)
Sta. 77016
ug Dust/m3 Air
600
500
400
300
200
100
Coefficient of Haze
1.0
0.5
ug BkF/1000 m3 Air
ug BaP/1000 m3 Air
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Color of Extract
Wind
1972
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
1973

FIGURE 29-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WELLAND (St. Peter & Paul School) Number: 27027

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1971/72	Number	Dust mg.	Air m^3	Dust/Air $\mu g./m^3$	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]	$\mu g.$	$\mu g.$	Visual a.u.[3]	Optical D.[4]	$\mu g.$	$\mu g.$
18/12/71	025	714.7	2583	276.7	Sat.	N	13.8	n.a.	7.90	2.46	2	25.8	2.19	0.68
26/12	001	670.0	2583	259.4	Sun.	W	6.7	n.a.	65.0	23.1	1	75.6	16.9	5.98
3/1/72	002	144.8	2374	61.0	Mon.	W	11.6	n.a.	42.3	11.8	3	27.0	2.58	0.72
11/1	003	1939.1	2428	798.6	Tue.	SW	9.7	n.a.	6.73	3.30	2	34.8	4.54	2.23
19/1	004	967.6	2244	431.2	Wed.	W	15.6	n.a.	83.3	n.a.	2	144	36.3	n.a.
27/1	005	925.3	2298	402.7	Thu.	W	10.9	n.a.	50.3	3.16	1	91.2	20.3	1.27
4/2	006	216.4	2558	84.6	Fri.	W	27.4	n.a.	127.0	n.a.	2	40.8	10.72	n.a.
12/2	007	530.3	2611	203.1	Sat.	S	7.6	n.a.	141.0	45.6	1+	107	28.7	9.27
15/3	009	265.8	2521	105.4	Wed.	NW	4.3	n.a.	178.0	51.5	1	107	18.8	5.43
23/3	010	845.2	2301	367.3	Thu.	NW	15.2	n.a.	479.0	315.0	1++	797	176.0	116.0
31/3	011	429.2	2203	194.8	Fri.	SW	5.5	n.a.	41.4	5.85	2	73.2	8.08	1.14
8/4	012	279.3	2179	128.2	Sat.	N	11.1	n.a.	133.0	21.6	1+	126	17.1	2.77
24/4	014	301.6	2497	120.8	Mon.	SW	7.3	n.a.	85.3	24.7	1+	107	10.3	3.0
2/5	015	735.3	2326	316.1	Tue.	SW	13.0	n.a.	50.5	26.4	1+	79.8	16.0	8.3
18/5	017	392.8	2701	145.4	Thu.	S	5.2	n.a.	5.17	3.85	3	28.2	0.75	0.56
26/5	018	518.4	2595	199.8	Fri.	S	8.3	n.a.	4.80	3.09	2	27.0	0.96	0.62

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 38-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WELLAND (St. Peter & Paul School) Number: 27027

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual a.u. 3)	Optical D. 4)		
3/6	019	1157.3	2530	457.4	Sat.	SW	11.6	n.a.	6.80	4.59	1	42.0	3.11	2.10
27/6	022	266.8	2394	111.4	Tue.	SW	8.5	n.a.	3.84	2.17	3	9.6	0.43	0.24
5/7	023	246.7	2345	105.2	Wed.	N	8.7	n.a.	68.6	128.0	1	37.2	7.22	13.5
13/7	026	1299.2	1900	683.8	Thu.	SW	14.0	n.a.	10.2	9.34	1+	63.6	6.97	6.39
21/7	027	547.2	2170	252.2	Fri.	SW	10.6	n.a.	35.6	12.9	1	81.0	8.98	3.25
29/7	028	251.4	2195	114.5	Sat.	n.a.	n.a.	n.a.	23.0	13.9	2	27.0	2.63	1.59
6/8	029	379.7	2122	178.9	Sun.	S	6.9	n.a.	39.4	20.9	2	40.2	7.06	3.74
22/8	031	908.3	2146	423.3	Tue.	S	10.7	n.a.	13.7	3.90	1	45.0	5.81	1.65
30/8	032	435.4	2219	196.2	Wed.	SW	5.1	n.a.	5.85	3.74	3	20.4	1.15	0.73
9/10	036	142.4	2305	61.8	Mon.	Sev.	17.5	n.a.	2128.0	843.0	1+	91.0	131.0	52.0
17/10	037	234.0	2142	109.2	Tue.	NW	18.2	n.a.	452.0	41.3	1+	258	49.5	4.52
25/10	038	185.9	2305	80.7	Wed.	NW	10.8	n.a.	288.0	23.4	1	114	23.2	1.89
2/11	039	550.8	2187	251.9	Sat.	SE	10.8	n.a.	18.1	3.96	2	40.8	4.57	1.00
18/11	041	332.8	2117	157.2	Sat.	WNW	8.9	n.a.	64.6	27.5	2	55.8	10.2	4.32
26/11	042	840.0	1864	450.6	Sun.	SW	29.0	n.a.	3.68	1.11	2	27.0	1.66	0.50
4/12	043	121.3	2003	60.6	Mon.	NE	20.1	n.a.	7.98	5.35	4	9.6	0.48	0.32

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WELLAND Number: 27027

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
12/12	44	239.4	2048	116.9	Tue.	NE	10.7	n.a.	28.2	9.38	1	39.6	3.30	1.10
20/12	45	671.4	2028	331.1	Wed.	NE	10.4	n.a.	51.7	23.0	1	105.0	17.5	7.78
28/12	46	191.5	2048	93.5	Thu.	NE	10.	n.a.	9.67	8.24	3	18.0	0.90	0.77
1973														
5/1	47	366.3	2028	180.6	Fri.	W	16.9	n.a.	41.7	7.58	1	58.2	7.53	1.37
13/1	48	558.7	2048	272.8	Sat.	SW	12.8	n.a.	62.1	28.4	1+	87.6	17.0	7.74
29/1	51	436.5	2003	217.9	Mon.	NW	17.5	n.a.	400.	252.	1+	246.	87.0	54.8
6/2	52	203.7	1958	104.0	Tue.	E	9.0	n.a.	9.09	7.74	3	18.6	0.95	0.81
14/2	53	417.7	2003	208.5	Wed.	E	3.8	n.a.	15.3	8.75	1	57.6	3.19	1.82
22/2	54	393.7	1909	206.2	Thu.	W	10.4	n.a.	82.3	29.3	1	93.	17.0	6.04
2/3	55	801.9	1726	464.6	Fri.	S	3.9	n.a.	20.3	13.4	1+	123.	9.43	6.24
10/3	56	369.6	1750	211.2	Sat.	E	5.7	n.a.	9.57	3.56	2	36.	2.02	0.75
3/4	57	285.4	1656	172.3	Tue.	N	2.8	n.a.	12.7	6.03	3	28.8	2.19	1.04
11/4	58	397.4	2105	188.8	Wed.	NW	15.9	n.a.	357.	60.2	1++	435.	67.4	11.4
19/4	59	335.6	2122	158.2	Thu.	ENE	5.2	n.a.	7.34	4.19	2	30.6	1.16	0.66
27/4	60	82.2	2105	39.1	Fri.	NE	13.7	n.a.	376.	88.4	1	91.8	14.7	3.45

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 38-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WELLAND Number: 27027

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
5/5	61	272.3	2085	130.6	Sat.	NW	12.3	n.a.	582.	169.	1+	339.	76.0	22.1
13/5	62	943.7	2142	440.6	Sun.	W	10.8	n.a.	24.0	8.16	1+	85.8	10.6	3.60
29/5	63	980.8	2040	480.8	Tue.	SW	9.6	n.a.	12.6	6.27	1+	41.4	6.05	3.01
6/6	65	669.8	1995	335.7	Wed.	SW	11.8	n.a.	18.1	13.0	1+	102.	6.09	4.35
14/6	66	431.0	1995	216.0	Thu.	SW	6.8	n.a.	42.0	27.6	1+	72.	9.08	5.95
22/6	68	642.1	2219	289.4	Fri.	SW	7.5	n.a.	31.8	10.9	1+	43.2	9.19	3.16
30/6	67	346.9	2175	159.5	Sat.	SW	7.8	n.a.	13.5	6.48	2	12.6	2.15	1.03
8/7	69	911.0	2219	410.6	Sun.	SW	12.4	3.7	7.30	4.81	1	27.6	3.00	1.97
16/7	70	174.6	2289	76.3	Mon.	Sev.	5.6	0.3	19.6	7.08	2	10.8	1.50	0.54
24/7	71	289.1	2264	127.7	Tue.	NE	6.7	0.2	4.52	0.85	1	14.4	1.85	0.11
1/8	72	237.7	2085	114.0	Wed.	Sev.	6.8	0.3	17.7	5.74	3	10.8	2.01	0.66
9/8	73	892.5	2085	428.1	Thu.	SW	13.7	3.2	27.2	12.8	1+	76.2	11.7	5.50
17/8	74	281.2	2085	134.9	Fri.	NE	5.5	0.5	20.6	8.15	3	16.2	2.78	1.10
25/8	75	520.6	2040	255.2	Sat.	SW	5.5	0.9	47.3	7.65	1	44.4	12.1	1.95
2/9	76	447.9	2020	221.7	Sun.	SW	7.2	1.4	17.2	9.67	1	17.4	3.82	2.14
10/9	77	846.4	1750	483.7	Mon.	SW	9.1	2.3	19.3	3.69	1+	54.0	9.33	1.79

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 38-D

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WELLAND Number: 27027

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D. 4)		
18/9	78	159.0	2064	77.0	Tue.	NW	8.2	0.3	229.0	50.1	1	45.0	17.7	3.86
26/9	79	451.5	1950	231.5	Wed.	S	8.0	0.3	11.4	3.74	1	27.0	2.65	0.87
7/10	80	208.7	1975	105.7	Sun.	NE	5.4	0.3	31.2	17.4	1+	33.6	3.30	1.84
13/10	81	600.1	1840	326.1	Sat.	SW	15.9	1.1	35.4	7.89	1+	63.0	11.6	2.57
19/10	82	245.0	1995	122.8	Fri.	SW	8.3	1.4	1123.	446.	1+	327.	138.	54.7
26/10	84	647.8	2081	311.3	Fri.	W	8.1	1.2	59.4	12.3	2	49.8	18.5	3.82
27/10	85	125.8	2379	52.9	Sat.	Sev.	7.9	0.2	53.5	12.9	4	15.6	2.83	0.68
1/11	87	325.4	2232	145.8	Thu.	W	17.9	0.7	22.9	8.37	4	21.	3.34	1.22
4/11	89	183.6	2227	82.4	Sun.	NW	13.5	0.2	1133.	56.6	1+	210.	93.4	4.67
5/11	90	353.3	2135	165.5	Mon.	W	13.0	0.2	246.	29.9	1+	138.	40.9	4.95
8/11	92	656.9	2033	323.1	Thu.	W	15.8	1.6	126.	45.9	1+	168.	40.7	14.8
9/11	94	209.6	2115	99.1	Fri.	W	12.6	0.2	445.	32.4	1+	135.	44.1	3.21
10/11	95	154.9	1966	78.8	Sat.	NW	10.4	0.2	147.	24.8	2	55.2	11.6	1.95
12/11	96	607.3	1873	324.2	Mon.	SW	16.4	2.1	45.3	6.60	1	88.2	14.7	2.14
14/11	98	798.7	1488	536.8	Wed.	SW	13.0	2.0	18.8	8.41	1	47.4	10.1	4.51
15/11	99	076.3	1966	38.8	Thu.	NE	10.8	0.2	35.2	9.18	4	15.0	1.37	0.36

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 38-E

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WELLAND Number: 27027

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
16/11	100	077.3	2101	36.8	Fri.	NW	12.2	0.2	686.	194.	2	76.2	25.2	7.13
18/11	127	296.4	1966	150.8	Sun.	E	5.8	1.2	28.7	14.5	2	40.2	4.32	2.18
19/11	128	217.1	2101	103.3	Mon.	NE	4.7	0.7	29.4	5.98	2	40.2	3.03	0.62
20/11	129	124.0	1966	63.1	Tue.	E	8.5	0.4	42.8	25.5	2	31.8	2.70	1.61
21/11	130	250.5	2060	121.6	Wed.	S	11.3	0.5	42.2	15.1	3	24.6	5.13	1.84
22/11	103	1179.5	1338	881.5	Thu.	SW	10.4	2.9	24.8	3.17	2	37.2	21.9	2.79
23/11	104	929.5	1693	549.0	Fri.	SW	6.9	2.5	29.4	3.63	2	50.4	16.1	1.99
24/11	105	616.7	1469	419.8	Sat.	E	10.4	1.8	25.6	2.75	3	36.6	10.8	1.15
27/11	106	389.0	2060	188.8	Tue.	Sev.	3.5	1.7	5.61	0.45	3	42.6	1.06	0.09
28/11	107	281.0	1750	160.6	Wed.	W	10.7	1.3	696.	11.9	1	195.	112.	1.91
30/11	108	444.7	1599	278.1	Fri.	W	17.3	1.2	169.	32.4	2	70.2	47.0	9.02
1/12	109	119.0	2060	57.8	Sat.	N	9.0	0.2	11.4	8.30	3	16.2	0.66	0.48
3/12	110	1296.2	755	1716.8	Mon.	SW	17.1	5.4	12.4	7.57	1+	53.4	21.3	13.0
5/12	112	797.6	1489	535.7	Wed.	W	11.0	1.5	27.1	0.12	1	52.8	14.5	0.06
8/12	113	178.9	1705	104.9	Sat.	E	5.9	0.4	67.9	28.4	1	48.6	7.13	2.98
11/12	116	103.1	1632	63.2	Tue.	W	9.8	0.5	370.	26.3	2	42.6	23.4	1.66

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 38-F

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WELLAND Number: 27027

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D. 4)		
12/12	115	160.0	2081	76.9	Wed.	S	6.6	0.8	83.9	15.1	2	38.4	6.45	1.16
13/12	117	125.0	1622	77.1	Thu.	E	6.8	0.6	32.2	39.0	1	36.0	2.48	3.00
17/12	118	51.4	1705	30.1	Mon.	N	15.9	0.2	40.9	28.2	4	13.2	1.23	0.85
18/12	119	173.6	1999	86.8	Tue.	NW	9.6	0.3	1384.	278.	1+	225.	120.	24.1
19/12	120	119.3	1620	73.6	Wed.	E	8.8	0.3	65.7	27.0	2	32.4	4.84	1.99
20/12	121	125.8	2101	59.9	Thu.	E	8.6	0.4	58.5	9.71	2	33.6	3.50	0.58
21/12	122	96.7	1665	58.1	Fri.	NW	17.7	0.3	872.	200.	1+	97.2	50.7	11.6
25/12	123	219.7	2183	100.6	Tue.	S	10.7	0.2	36.2	3.79	3	27.6	3.64	0.38
28/12	124	339.2	2101	161.4	Fri.	W	14.3	0.7	64.7	21.7	1	45.6	10.4	3.51
29/12	125	518.8	2007	258.5	Sat.	SW	12.4	1.8	109.	12.5	1+	74.4	28.1	3.22

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 38-G

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WINDSOR Number: 12008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air /ug.	BaP per 1000 m^3 Air /ug.
Date 1971	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical[4] D.		
6/7	94	200.3	2105	95.2	Tue.	S	5.6	0.5	2.58	0.78	4	11.7	0.25	0.07
15/7	97	395.4	2032	194.6	Thu.	SW	8.8	1.0	21.6	16.4	1	n.a.	4.21	3.18
27/7	101	357.6	2196	162.8	Tue.	S	7.7	0.5	8.46	2.13	1	31.1	1.38	0.35
11/8	106	645.0	2301	280.3	Wed.	NW	11.9	0.4	23.1	10.0	1+	96	6.47	2.81
29/8	112	268.1	2554	105.0	Sun.	W	7.0	0.5	4.28	2.49	4	15.5	0.45	0.26
13/9	117	245.7	2456	100.0	Mon.	N	12.8	0.5	3.35	2.53	3	n.a.	0.34	0.25
1/10	123	368.3	2550	144.4	Fri.	SE	6.9	0.9	3.22	1.99	3	16.7	0.47	0.29
16/10	128	346.7	2199	157.7	Sat.	N	8.2	1.0	4.00	1.39	2	18.0	0.63	0.22
31/10	133	299.4	2599	115.2	Sun.	SW	11.8	0.5	12.9	11.6	2	30.2	1.49	1.34
15/11	138	696.4	2224	313.1	Mon.	SW	10.8	0.9	13.6	10.5	1	52.3	4.26	3.28
3/12	144	714.3	2175	328.4	Fri.	SW	4.5	1.5	32.6	33.3	1+	n.a.	10.7	10.9
18/12	149	235.3	2530	93.0	Sat.	NW	10.3	0.4	6.85	6.86	3	n.a.	0.64	0.64

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 10 ml cyclohexane extract.

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WINDSOR Number: 12008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air /ug.	BaP per 1000 m^3 Air /ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical 4) D.		
2/1	151	242.6	2097	115.7	Sun.	SW, W	10.9	0.5	49.4	71.2	1	n.a.	5.71	8.23
20/1	157	169.9	1946	87.3	Thu.	W	8.3	0.8	5.89	4.26	1	38.5	0.51	0.37
4/2	162	289.0	2313	124.9	Fri.	W	24.7	0.4	2.07	1.02	2	15.8	0.26	0.13
13/2	165	311.1	2048	151.9	Sun.	NW	9.8	1.4	15.7	7.55	1	51.0	2.39	1.15
19/2	167	305.1	1971	154.8	Sat.	NW	21.6	0.5	5.18	3.75	2	36.2	0.80	0.58
8/3	173	280.9	1971	142.5	Wed.	NW	18.9	0.3	3.81	1.68	2+	34.7	0.54	0.24
23/3	178	158.3	2260	70.0	Thu.	NW	15.8	0.4	5.30	2.64	3	22.9	0.37	0.19
9/4	183	270.1	2260	119.5	Sun.	SW.	6.8	0.3	2.63	2.06	3	22.9	0.31	0.25
24/4	188	302.7	2048	147.8	Mon.	N	12.0	0.3	3.78	2.51	3	28.4	0.56	0.37
3/5	191	312.9	2260	138.5	Wed.	W	10.4	0.4	1.50	0.09	1	38.0	10.8	0.68
9/5	193	256.2	2260	113.4	Tue.	N	17.1	0.2	647	132	3	H.F.	73.4	14.9
27/5	199	376.5	2236	168.4	Sat.	E	7.8	0.3	2.77	2.20	2	19.1	0.47	0.37
11/6	207	299.3	1946	153.8	Sun.	S	7.4	0.3	8.05	4.33	1	33.3	1.24	0.67
26/6	212	367.6	2133	176.6	Mon.	NE	2.8	0.4	3.27	2.28	2	27.3	0.56	0.39
11/7	217	479.3	1917	250.0	Tue.	S	7.6	1.0	12.2	9.92	1+	84	3.05	2.48

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 39-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WINDSOR Number: 12008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical 4) D.		
29/7	222	199.3	1875	106.3	Sat.	NE	4.8	0.03	1.70	1.81	3	9.5	0.18	0.19
7/8	225	169.0	1852	91.3	Mon.	NW	7.7	0.3	2.18	1.99	4	13.8	0.20	0.18
22/8	230	197.8	2048	96.6	Tue.	S	9.6	0.3	1.29	0.57	4	10.8	0.12	0.05
9/9	236	175.2	1938	90.4	Sat.	NE	11.4	0.1	2.97	2.41	4	14.4	0.27	0.22
24/9	241	282.5	1975	143.0	Sun.	S	6.7	0.4	8.00	2.14	2+	31.8	1.14	0.31
9/10	246	212.2	2024	104.8	Mon.	NW	7.7	0.3	21.5	19.5	1	55.8	2.26	2.05
24/10	251	347.7	2060	168.8	Tue.	NW	11.1	0.2	13.4	7.96	1	57.6	2.26	1.34
8/11	256	202.3	2166	93.4	Wed.	NW	16.3	0.2	4.58	3.63	3	26.4	0.43	0.34
23/11	261	322.9	2142	150.7	Thu.	SW	13.1	0.4	29.6	21.7	1+	88.2	4.47	3.27
8/12	266	227.4	2166	105.0	Fri.	SE	4.3	n.a.	12.7	7.87	1+	59.4	1.33	0.83
22/12	271	268.7	2158	124.5	Fri.	N	3.8	1.8	1.90	2.11	1+	64.8	0.24	0.26

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 39-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: WINDSOR Number: 12008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
7/1	276	193.9	1877	103.3	Sun.	E	7.3	0.3	7.69	6.98	1	31.8	0.79	0.72
22/1	281	244.8	1730	141.5	Mon.	SE	15.6	0.5	291.	251.	1+	288.	41.2	35.4
6/2	286	269.8	1595	169.2	Tue.	NE	8.7	0.7	9.68	8.05	1	34.2	1.64	1.36
21/2	291	155.4	1926	80.7	Wed.	NW	18.3	0.4	20.5	6.86	1+	37.8	1.65	0.55
8/3	295	603.9	2170	278.3	Thu.	N	10.2	0.6	18.8	6.78	1+	75.0	5.23	1.89
23/3	300	380.2	2113	179.9	Fri.	S	3.0	0.5	4.36	1.92	1	47.4	0.78	0.35
7/4	305	320.0	2391	133.8	Sat.	NE	15.1	0.3	4.05	4.33	2	24.6	0.54	0.58
22/4	310	170.6	1975	86.4	Sun.	W	14.6	0.3	14.2	13.3	1	27.6	1.23	1.15
7/5	315	168.1	2440	68.9	Mon.	SE	12.5	0.2	39.1	29.3	1+	33.6	2.69	2.02
19/5	319	269.4	2415	111.6	Sat.	SE	8.6	0.3	4.17	1.38	4	19.8	0.47	0.15
3/6	324	338.5	2011	168.3	Sun.	SE	9.5	0.4	48.5	16.2	1+	48.6	8.16	2.72
18/6	329	320.9	1734	185.1	Mon.	E	4.0	0.5	17.3	8.45	1	34.8	3.21	1.56
3/7	335	257.8	1860	138.6	Tue.	W	8.4	0.5	14.3	10.6	2	22.2	1.99	1.47
18/7	340	132.8	1799	73.8	Wed.	S	3.8	n.a.	7.94	5.24	3	15.6	0.59	0.39

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: HAMILTON Number: 29008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1971	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]	ug.	ug.	Visual[3] a.u.	Optical[4] D.	ug.	ug.
3/7	72	237.2	2048	115.8	Sat.	NE	6.0	0.1	1.55	0.37	4	n.a.	0.18	0.04
19/7	74	256.8	2093	122.7	Mon.	NE	6.0	0.2	1.62	1.25	3	n.a.	0.20	0.15
27/7	76	204.3	2183	93.6	Tue.	W	6.0	0.5	24.8	10.5	1	20.9	2.32	0.98
12/8	78	376.3	2183	172.4	Thu.	SW	8.7	0.7	15.1	5.93	1	41.0	2.60	1.02
28/8	80	158.1	2183	72.4	Sat.	NW	6.8	0.2	2.63	1.12	4	7.4	0.19	0.08
13/9	83	124.9	2183	57.2	Mon.	NE	9.2	0.1	2.01	1.27	4	8.8	0.12	0.07
29/9	87	367.9	2158	170.5	Wed.	SW	8.6	0.8*	31.5	23.6	1	61.8	5.38	4.02
15/10	91	468.3	2113	221.6	Fri.	SW	6.0	1.3	19.8	9.18	2	H.F.	4.39	2.03
31/10	95	362.0	2224	162.8	Sun.	SW	9.0	0.5	31.0	25.1	1	59.9	5.05	4.08
16/11	99	125.1	2248	55.6	Tue.	NW	4.1	0.5	3.97	4.35	3	12.3	0.22	0.24
28/11	102	469.0	2224	210.9	Sun.	W	5.1	0.1	24.5	32.7	1	67.8	5.18	6.90
18/12	104	261.9	2048	127.9	Sat.	NW	10.8	0.3	5.16	6.41	3	n.a.	0.66	0.82

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 40-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: HAMILTON Number: 29008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
12/1	107	468.0	2028	230.8	Wed.	SW	9.1	0.9	19.9	10.6	1	86.4	4.58	2.44
19/1	108	236.4	2095	112.8	Wed.	W	18.4	0.6	8.05	0.11	3	26.3	0.91	0.01
12/2	111	654.7	2175	301.0	Sat.	S, SW	7.4	1.6	18.2	10.5	2	85.8	5.49	3.17
13/2	29025 -611	385.9	2142	180.2	Sun.	NE	14.0	1.2	48.1	31.4	1	n.a.	8.66	5.66
20/2	112	190.5	2258	84.4	Sun.	NW	19.4	0.2	2.18	1.75	2	17.5	0.18	0.15
7/3	114	469.2	2117	221.6	Tue.	SW	22	n.a.	30.7	16.3	1+	80.4	6.81	3.60
23/3	116	196.7	2040	96.4	Thu.	NW	15.3	0.1	9.34	4.96	2	23.8	0.90	0.48
8/4	118	157.3	2109	74.6	Sat.	N	14.0	0	3.36	2.21	4	11.6	0.25	0.17
16/4	119	207.9	2203	94.4	Sun.	NE	16.0	0.3	2.40	1.19	3	18.0	0.23	0.11
1/5	29025 -696	232.9	2350	99.1	Mon.	NE	6.5	1.5	96.8	94.6	1++	n.a.	9.59	9.38
2/5	121	305.3	1938	157.5	Tue.	SW	11.9	0.9	7.81	6.48	2	n.a.	1.23	1.02
10/5	122	248.9	1958	127.1	Wed.	NW	11.3	0.6	5.13	4.54	3	20.2	0.65	0.58
25/5	133	167.3	1696	98.6	Thu.	NE	16.1	n.a.	5.82	13.2	4	n.a.	0.57	1.31
9/6	139	179.1	2015	88.9	Fri.	N	10.8	0.4	0.60	0.22	4	9.5	0.05	0.02
21/7	145	420.3	1952	215.3	Fri.	NW	9.7	0.8	11.4	7.77	1+	36.6	2.45	1.67

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 10 ml cyclohexane extract.

TABLE 40-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: HAMILTON Number: 29008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.[4]		
29/7	146	277.7	1930	143.9	Sat.	N	3.0	0.3	3.51	2.20	3	15.8	0.50	0.32
14/8	150	366.3	1975	185.5	Mon.	NE,SW	12.5	n.a.	17.9	8.88	1+	60.6	3.32	1.65
22/8	151	542.8	1905	284.9	Tue.	SW	10.1	0.1	13.7	7.35	1+	58.8	3.89	2.09
7/9	153	687.2	1795	382.8	Thu.	SW	11.3	0.1	19.6	9.04	1+	46.8	7.51	3.46
23/9	155	199.8	1952	102.4	Sat.	NE	4.3	0.2	3.30	1.79	3	19.8	0.34	0.18
9/10	157	87.5	2350	37.2	Mon.	W	10.0	0.2	3.94	2.52	4	11.4	0.15	0.09
25/10	159	297.0	2330	127.5	Wed.	SW	5.3	0.9	37.0	21.7	1+	69.6	4.72	2.77
10/11	161	95.1	1962	48.5	Fri.	NE	11.7	0.1	3.32	2.86	4	9.0	0.16	0.14
26/11	163	149.1	1938	76.9	Sun.	SW	12.3	0.3	25.9	20.1	1+	36.6	2.00	1.55
12/12	165	180.7	2073	87.2	Tue.	E	6.0	0.6	9.61	7.35	4	17.4	0.84	0.64
28/12	167	181.1	2126	85.2	Thu.	NW	10.3	0.3	2.81	1.65	4	13.2	0.24	0.14

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 40-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: HAMILTON Number: 29008

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.[4]		
13/1	169	710.8	1828	388.8	Sat.	SW	10.5	0.5	28.9	18.0	1+	94.8	11.2	7.00
21/1	170	167.5	1909	87.7	Sun.	NE	2.7	0.1	4.56	0.70	4	11.4	0.40	0.06
6/2	178	185.1	1722	107.5	Tue.	NE	10.8	n.a.	1.98	1.96	4	15.0	0.21	0.21
22/2	180	297.8	1722	172.9	Thu.	W	8.9	0.6	4.92	1.53	3	n.a.	0.85	0.26
2/3	181	356.2	1693	210.4	Fri.	NE	5.3	0.9	10.2	11.3	3	24.6	2.14	2.36
18/3	183	93.3	1722	54.2	Sun.	NW	19.7	0.1	3.07	1.58	4	7.2	0,17	0.09
3/4	185	86.7	1828	47.4	Tue.	NE	4.0	0.2	3.42	1.84	4	9.0	0.16	0.09
19/4	187	176.5	1962	90.0	Thu.	E	5.9	0.2	1.71	1.00	4	7.8	0.15	0.09
5/5	189	123.1	1938	63.5	Sat.	NW	15.4	0.2	3.89	4.06	4	11.4	0.25	0.26
21/5	191	176.4	1991	88.6	Mon.	NW	6.9	0.4	3.24	1.91	3	16.2	0.29	0.17
6/6	193	370.1	1885	196.3	Wed.	SW	7.4	1.7	137.	119.	1+	67.2	27.0	23.4
22/6	195	379.2	1804	210.2	Fri.	W	6.3	1.05	39.3	18.2	2	30.0	8.27	3.82
8/7	197	502.8	1452	346.3	Sun.	SW	9.5	0.6	132.	65.7	1++	159.	45.7	22.7
24/7	171	187.9	1803	104.2	Tue.	NE	7.8	0.2	3.63	0.72	4	12.0	0.38	0.08

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 40-D

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SAULT ST. MARIE Number: 71021

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1971	Number	Dust mg.	Air m^3	Dust/Air $\mu g./m^3$	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]	$\mu g.$	$\mu g.$	Visual[3] a.u.	Optical D.	$\mu g.$	$\mu g.$
4/7	068	126.4	2505	50.5	Sun.	E	5.8	0.2	1.78	1.81	4	6.0	0.09	0.09
12/7	067	191.4	2505	76.4	Mon.	SE	6.4	0.3	1.43	0.77	3	11.4	0.11	0.06
27/7	086	117.8	2530	46.6	Tue.	SE	3.7	0.3	22.2	24.8	1	34.2	1.03	1.16
12/8	162	169.7	2530	67.1	Thu.	SW	10.8	0.2	8.68	5.11	2	23.4	0.58	0.34
5/9	164	106.8	2595	41.2	Sun.	S,E	2.8	0.2	4.74	10.8	4	7.2	0.19	0.44
21/9	166	140.3	2530	55.5	Tue.	SW	7.1	0.3	14.6	7.86	2	22.2	0.81	0.44
2/12	174	91.3	2376	38.4	Thu.	n.a.	n.a.	n.a.	4.27	7.50	4	13.2	0.16	0.29
10/12	175	59.2	2191	27.0	Fri.	n.a.	n.a.	n.a.	12.1	5.31	3	18.0	0.33	0.14
18/12	176	55.6	2146	25.9	Sat.	n.a.	n.a.	n.a.	7.21	4.72	4	11.4	0.19	0.12

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 41-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SAULT ST. MARIE Number: 71021

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air /ug.	BaP per 1000 m^3 Air /ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D.		
11/1	178	88.2	2033	43.4	Tue.	SW	15.8	0.3	6.06	0.31	4	9.6	0.26	0.02
6/3	182	94.8	2305	41.1	Mon.	E	8.0	0.4	53.00	20.90	1	39.6	2.18	0.86
14/3	183	90.3	2260	40.0	Tue.	NE	4.4	0.1	5.41	2.13	4	9.0	0.22	0.09
31/3	185	208.2	2260	92.1	Fri.	S	9.9	0.5	2.86	1.05	4	15.6	0.26	0.10
8/4	188	370.7	2191	169.2	Sat.	W	8.0	n.a.	2.25	1.34	2	36.6	0.38	0.33
24/4	190	277.4	2350	118.0	Mon.	N	10.0	n.a.	6.13	6.70	3	21.6	0.72	0.79
2/5	191	94.6	2350	40.3	Tue.	E	11.4	n.a.	2.19	1.23	4	9.0	0.09	0.05
3/6	194	273.0	2244	121.7	Sat.	W,NW	6.3	n.a.	2.76	0.89	3	12.0	0.34	0.11
20/6	196	155.2	2350	66.0	Tue.	E	9.2	n.a.	2.05	0.99	4	9.6	0.14	0.07
27/6	197	241.9	2246	107.7	Tue.	W	8.3	n.a.	5.37	5.03	3	18.0	0.58	0.54
13/7	199	145.7	1828	79.7	Thu.	W	2.1	n.a.	2.28	0.98	4	8.4	0.18	0.08

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 41-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SAULT STE. MARIE Number: 71021

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)	ug.	ug.	3) Visual a.u.	4) Optical D.	ug.	ug.
10/10	206	250.2	2305	108.5	Tue.	SE	7.7	0.4	313.	208.	1++	510.	34.0	22.5
25/10	208	319.8	2077	154.0	Wed.	S	6.2	0.4	4.07	3.77	1	39.0	0.62	0.58
18/11	210	102.3	2146	47.7	Sat.	W	6.4	0.3	17.5	22.7	1	40.2	0.84	1.08
Date 1973														
5/1	215	54.3	1942	28.0	Fri.	NW	15.0	0.3	17.0	6.95	1	16.2	0.48	0.19
21/1	217	27.8	1689	16.5	Sat.	E	7.3	n.a.	19.2	7.11	2	13.8	0.32	0.12
6/2	219	53.2	1913	27.8	Tue.	E	8.6	n.a.	17.0	5.72	3	13.2	0.47	0.16
22/2	221	57.8	1942	29.8	Thu.	E	6.5	0.1	12.4	5.08	1	19.8	0.37	0.15
2/3	222	90.1	1942	46.4	Fri.	E	5.3	0.1	5.17	3.07	2	14.4	0.24	0.14
3/4	225	67.6	1987	34.0	Tue.	N	8.0	0.1	4.12	2.85	4	10.2	0.14	0.10
19/4	227	244.1	1962	124.4	Thu.	E	11.2	0.2	1.84	1.39	3	19.2	0.23	0.17
5/5	229	146.3	1962	74.6	Sat.	W	13.5	0.1	1.52	24.2	1+	65.4	11.3	1.80
29/5	232	147.1	1962	75.0	Tue.	NW	10.3	0.2	7.33	1.83	4	15.0	0.55	0.14
14/6	234	251.0	1918	130.9	Thu.	W	3.4	0.2	12.0	4.68	2	27.0	1.57	0.61
30/6	236	59.7	1962	30.4	Sat.	W	2.0	0.2	7.67	1.50	4	7.8	0.23	0.05
16/7	238	70.6	2032	34.7	Mon.	W	5.3	0.2	30.00	11.2	4	20.4	1.04	0.39

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 41-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: CORNWALL Number: 56066

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1971	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D.		
3/7	30	586.8	2060	284.9	Sat.	Sev.	6.1	n.a.	11.5	1.20	1		3.28	0.30
19/7	32	151.5	2061	73.5	Mon.	SW	6.3	0.1	50.5	5.34	2		3.71	0.39
27/7	33	127.4	2106	60.5	Tue.	Sev.	11.5	0.1	13.0	0.58	4		0.79	0.04
12/8	35	120.6	2081	58.0	Thu.	n.a.	n.a.	0.1	52.8	3.56	3		3.06	0.21
28/8	37	642.1	1877	342.1	Sat.	n.a.	n.a.	0.1	39.0	7.27	1		13.3	2.48
29/9	39	191.8	1840	104.2	Wed.	SW	12.1	0.2	45.2	10.9	2		4.71	1.13
7/10	40	78.4	1644	47.7	Thu.	n.a.	n.a.	0.1	3.16	1.88	4		0.15	0.09

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1

TABLE 42-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: CORNWALL Number: 56051

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air /ug.	BaP per 1000 m^3 Air /ug.
Date 1971	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual a.u.[3]	Optical D.		
2/7	77	110.4	1730	63.8	Fri.	NW	11.1	n.a.	1.95	0.85	4	6.0	0.12	0.05
17/7	82	104.5	2001	52.2	Sat.	SW	9.2	0.1	3.73	3.36	4	4.8	0.20	0.18
29/7	86	146.3	1868	78.3	Thu.	SW	6.0	0.3	4.10	2.01	3	n.a.	0.32	0.16
13/8	91	207.0	2309	89.6	Fri.	n.a.	n.a.	0.3	7.31	3.13	4	9.0	0.65	0.28
31/8	97	123.4	2330	53.0	Tue.	n.a.	n.a.	n.a.	3.60	2.60	4	7.8	0.19	0.14
15/9	102	167.1	2454	68.1	Wed.	W	6.6	0.2	52.5	26.5	1	32.4	3.58	1.80
30/9	107	146.1	2354	62.1	Thu.	W	4.8	0.2	6.01	4.95	3	14.4	0.37	0.31
15/10	125	297.5	2297	129.5	Fri.	n.a.	n.a.	0.3	6.83	5.23	3	20.4	0.88	0.68
30/10	113	231.7	2354	98.4	Sat.	n.a.	n.a.	0.4	8.77	6.72	2	21.0	0.86	0.66
14/11	118	195.4	2244	87.1	Sun.	NE	8.0	0.6	14.0	14.0	1	26.4	1.22	1.22
30/11	133	67.9	2297	29.5	Tue.	NW	16.0	0.1	12.9	16.9	3	10.8	0.38	0.50

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4.) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract

TABLE 42-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: CORNWALL Number: 56051 Table 10

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air /ug.	BaP per 1000 m^3 Air /ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.		
20/1	178	117.2	2040	57.5	Thu.	n.a.	n.a.	0.4	8.76	3.09	4	12.0	0.50	0.18
1/2	185	141.8	2142	66.2	Tue.	n.a.	n.a.	0.4	5.41	5.17	2	15.6	0.36	0.34
15/2	192	113.0	1958	57.7	Tue.	n.a.	n.a.	0.3	44.8	15.1	3	21.0	2.58	0.87
29/2	199	100.4	2289	43.9	Tue.	n.a.	n.a.	0.3	6.49	3.76	4	12.6	0.28	0.16
12/3	205	43.2	2162	18.9	Sun.	n.a.	n.a.	0.4	43.1	23.1	4	16.2	0.86	0.46
26/3	211	66.6	2268	29.4	Sun.	n.a.	n.a.	0.2	1.93	0.67	4	5.4	0.06	0.02
9/4	218	146.4	2244	65.2	Sun.	n.a.	n.a.	0.1	4.99	2.83	2	10.2	0.33	0.18
25/4	227	160.4	2268	70.7	Tue.	n.a.	n.a.	0.1	2.91	2.61	4	7.8	0.21	0.18
9/5	234	259.1	2007	129.1	Tue.	n.a.	n.a.	0.2	8.15	6.79	2	16.2	1.05	0.88
4/6	244	178.3	2277	78.3	Sun.	n.a.	n.a.	n.a.	2.06	1.63	3	6.0	0.16	0.13
30/6	250	216.9	2355	92.1	Fri.	n.a.	n.a.	0.3	1.65	1.64	4	6.6	0.15	0.15

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 1/4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: CORNWALL Number: 56051

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D. 4)		
3/10	282	208.9	2411	86.6	Tue.	n.a.	n.a.	0.5	19.9	6.58	3	23.4	1.73	0.57
16/10	299	96.2	2338	41.2	Mon.	n.a.	n.a.	0.5	475.	163.	1	70.2	19.5	6.70
31/10	304	186.1	2338	79.6	Tue.	n.a.	n.a.	0.	6.42	5.06	2	16.8	0.51	0.40
15/11	309	195.0	1811	107.7	Wed.	n.a.	n.a.	0.1	10.3	6.37	2	22.2	1.10	0.69
30/11	312	120.6	2313	52.1	Thu.	n.a.	n.a.	0.2	17.0	8.66	3	15.0	0.88	0.45
15/12	314	136.9	1714	79.9	Fri.	n.a.	n.a.	0.3	6.28	1.69	3	13.2	0.50	0.13
27/12	318	71.8	1738	41.3	Wed.	n.a.	n.a.	n.a.	20.3	13.2	4	18.6	0.84	0.55

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 42-D

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: CORNWALL Number: 56051

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
5/1	320	58.4	1987	29.4	Fri.	n.a.	n.a.	0.3	9.02	0.10	4	9.6	0.27	.01
20/1	327	49.2	2011	24.5	Sat.	n.a.	n.a.	0.1	6.33	4.34	4	10.8	0.15	0.11
4/2	332	102.3	2040	50.1	Sun.	n.a.	n.a.	0.2	6.01	2.52	4	10.8	0.30	0.13
22/2	338	77.2	1860	41.5	Thu.	n.a.	n.a.	0.3	10.6	3.94	3	14.4	0.44	0.16
3/3	341	151.5	1836	82.5	Sat.	n.a.	n.a.	0.5	5.13	1.70	4	15.0	0.42	0.14
18/3	346	94.3	2011	46.9	Sun.	n.a.	n.a.	0.3	5.76	1.57	4	10.8	0.27	0.07
2/4	349	60.5	2538	23.8	Mon.	n.a.	n.a.	0.2	4.74	3.18	4	6.60	0.11	0.08
17/4	354	248.7	2611	95.3	Tue.	n.a.	n.a.	0.2	6.66	4.89	3	18.6	0.63	0.47
5/5	359	60.5	2113	28.6	Sat.	n.a.	n.a.	0.1	3.84	0.53	4	6.6	0.11	0.02
17/5	361	166.7	2562	65.1	Thu.	n.a.	n.a.	0.2	6.96	2.03	4	10.2	0.45	0.13
1/6	368	161.1	2097	76.8	Fri.	n.a.	n.a.	0.1	13.1	7.49	4	9.0	1.01	0.58
16/6	373	70.9	2562	27.7	Sat.	n.a.	n.a.	0.2	5.45	4.20	4	5.4	0.15	0.12
1/7	378	166.0	2077	79.9	Sun.	n.a.	n.a.	0.2	36.6	5.36	1	17.4	2.93	0.43
16/7	383	124.7	2611	47.8	Mon.	n.a.	n.a.	0.1	8.71	0.43	3	10.8	0.42	0.02

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 42-E

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (College St.) Number: 31001

TABLE 43-A

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1971	Number	Dust mg.	Air m^3	Dust/Air $\mu g./m^3$	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]	$\mu g.$	$\mu g.$	Visual a.u.[3]	Optical D.	$\mu g.$	$\mu g.$
3/7	639	157.2	2195	71.6	Sat.	E	10.7	0.2	1.92	0.80	3	12.3	0.14	0.06
19/7	655	186.9	2558	73.1	Mon.	N/NE	9.5	0.3	3.62	1.01	3	n.a.	0.26	0.07
27/7	663	134.7	2175	61.9	Tue.	W	11.1	0.1	3.06	1.86	4	9.6	0.19	0.12
12/8	279	196.1	2226	88.1	Thu.	W	11.7	0.4	2.22	3.25	3	12.3	0.20	0.29
28/8	766	152.4	2321	65.7	Sat.	NW	8.0	0.3	2.36	1.39	3	13.8	0.16	0.09
13/9	694	163.5	2081	78.6	Mon.	N	10.5	0.3	2.54	1.88	3	19.8	0.20	0.15
29/9	711	325.9	2170	150.2	Wed.	SW	9.8	0.4	4.47	2.00	2	24.3	0.67	0.30
15/10	726	444.3	2166	205.1	Fri.	SW	4.8	1.2	4.15	3.78	2	15.3	0.85	0.78
31/10	742	257.9	2334	110.5	Sun.	E	11.7	0.5	5.21	1.02	2	21.3	0.58	0.11
16/11	772	334.6	2215	151.1	Tue.	E	6.0	0.7	7.52	5.01	2	44.7	1.14	0.76
2/12	788	165.7	2122	78.1	Thu.	W	10.6	0.6	6.35	8.70	2	30.6	0.50	0.68
18/12	804	197.1	2093	94.2	Sat.	NW	12.2	0.2	2.62	3.70	2	n.a.	0.25	0.35

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (College St.) Number: 31001

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1972	Number	Dust mg.	Air m^3	Dust/Air $\mu g./m^3$	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]	$\mu g.$	$\mu g.$	Visual[3] a.u.	Optical D.	$\mu g.$	$\mu g.$
3/1	3	156.9	1930	81.3	Mon.	W	10.8	0.4	4.81	5.32	2	30.6	0.39	0.43
20/1	17	108.7	1767	61.5	Thu.	W	8.7	0.4	4.16	2.47	3	19.8	0.26	0.15
4/2	34	80.6	1816	44.4	Fri.	W	27.4	0.3	5.35	4.23	3	12.3	0.24	0.19
12/2	42	187.5	1857	101.0	Sat.	S	5.3	1.1	21.5	7.45	2	37.5	2.17	0.75
13/2	43	322.1	1724	186.8	Sun.	NE	10.7	1.2	22.5	13.5	1	56.1	4.21	2.52
20/2	50	79.1	1832	43.2	Sun.	NW	18.6	0.3	4.66	4.39	2	18.3	0.20	0.19
7/3	66	188.5	1946	96.9	Tue.	SW	13.5	0.5	6.21	3.77	2	25.8	0.60	0.36
23/3	82	102.4	1746	58.6	Thu.	NW	13.0	0.3	5.16	3.09	2	24.3	0.30	0.18
9/4	100	118.6	1856	63.9	Sun.	W	8.9	0.3	3.39	2.68	3	19.8	0.22	0.17
25/4	110	174.6	1991	87.7	Tue.	N	10.0	0.2	3.08	2.58	1	37.5	0.27	0.23
1/5	121	498.6	1783	279.4	Mon.	E	7.5	1.2	12.8	7.14	1+	n.a.	3.59	2.00
2/5	122	296.6	1966	150.9	Tue.	E	11.0	0.7	4.43	1.60	2	n.a.	0.67	0.24
10/5	130	205.8	1750	117.6	Wed.	NW	12.5	0.3	5.18	3.33	2	n.a.	0.61	0.39
26/5	146	356.8	1816	196.5	Fri.	E	9.5	0.4	5.96	15.00	2	n.a.	1.17	2.95
10/6	161	142.5	1987	71.7	Sat.	NW	14.5	0.1	2.10	9.11	4	9.6	0.15	0.63
26/6	177	277.8	1805	153.9	Mon.	S	2.3	0.7	1.62	1.52	2	29.1	0.25	0.23
12/7	193	395.1	1746	226.3	Mon.	SW	7.0	0.3	2.47	1.72	2	22.8	0.56	0.39

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 43-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (College St.) Number: 31001

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1972	Number	Dust mg.	Air m^3	Dust/Air $\mu g./m^3$	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)	$\mu g.$	$\mu g.$	Visual 3) a.u.	Optical D. 4)	$\mu g.$	$\mu g.$
28/7	210	155.4	1954	79.5	Fri.	SW	4.5	0.2	2.32	2.52	3	14.4	0.18	0.20
16/8	229	196.5	1877	104.7	Wed.	E	7.2	0.4	3.06	1.82	3	22.2	0.32	0.19
1/9	245	369.3	2032	181.7	Fri.	S	4.6	0.7	1.89	1.08	2	18.0	0.34	0.20
15/9	259	218.2	1979	110.3	Fri.	SW	10.2	0.4	4.27	1.66	2	22.8	0.47	0.18
17/9	261	1938.	1901	1019.	Sun.	SW	11.2	0.2	2.27	0.94	4	10.8	0.23	0.10
29/9	273	160.7	1979	81.2	Fri.	S	7.6	0.6	4.84	2.80	1	25.8	0.39	0.23
13/10	287	162.2	1979	82.0	Fri.	SW	7.4	0.4	4.17	2.65	1	28.2	0.34	0.22
27/10	301	369.6	1897	194.8	Fri.	E	4.8	0.8	5.29	3.38	1	40.2	1.03	0.66
10/11	315	254.0	1926	131.9	Fri.	E	18.1	0.3	33.2	32.4	2	25.8	4.38	4.27
24/11	329	216.5	1869	115.8	Fri.	SW	19.3	0.5	4.70	3.06	2	25.2	0.54	0.35
8/12	343	118.7	1950	60.9	Fri.	E	7.8	0.4	7.69	4.88	4	17.4	0.47	0.30
22/12	357	142.9	2007	71.2	Fri.	NE	5.6	0.7	6.38	3.70	2	28.8	0.45	0.26

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 43-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (College St.) Number: 31001

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1973	Number	Dust mg.	Air m^3	Dust/Air $\mu g./m^3$	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]	$\mu g.$	$\mu g.$	Visual[3] a.u.	Optical D.[4]	$\mu g.$	$\mu g.$
5/1	371	219.2	2113	151.1	Fri.	W	22.7	0.3	3.82	3.79	1	27.6	0.40	0.39
21/1	387	123.4	2036	60.6	Sun.	E	14.0	0.2	4.03	4.35	2	17.4	0.24	0.26
6/2	405	199.4	2183	91.3	Tue.	E	20.1	0.4	6.92	2.53	1	23.4	0.62	0.23
22/2	423	129.3	1816	71.2	Thu.	N	13.4	0.3	3.73	4.05	3	14.4	0.27	0.29
2/3	431	376.1	2142	175.6	Fri.	E	10.9	1.3	3.57	2.33	1	34.8	0.63	0.41
18/3	446	97.6	2060	47.4	Sun.	NW	25.7	0.1	1.12	0.95	4	3.0	0.05	0.04
2/4	461	77.3	1881	41.1	Mon.	E	8.1	0.3	3.13	4.29	4	9.60	0.13	0.18
16/4	476	507.6	2138	237.4	Mon.	ENE	12.3	0.8	7.91	8.60	1	40.2	1.88	2.04
30/4	492	199.9	2044	97.8	Mon.	ENE	15.7	0.3	2.97	2.65	3	21.0	0.29	0.26
14/5	505	214.4	2093	102.4	Mon.	SSE	5.5	0.4	2.77	3.54	4	16.2	0.28	0.36
28/5	520	291.9	2207	132.3	Mon.	ENE	10.7	0.7	24.9	26.7	1	39.6	3.29	3.53
12/6	535	231.3	1975	117.1	Tue.	WSW	5.5	0.4	3.79	2.06	3	13.2	0.44	0.24
26/6	549	377.5	1824	207.0	Tue.	E	8.5	0.6	5.69	4.06	2	23.4	1.18	0.84
10/7	564	198.1	1701	116.5	Tue.	Sev.	8.1	0.4	4.08	2.24	3	13.8	0.48	0.26
24/7	578	230.7	1946	118.6	Tue.	E	9.0	0.4	4.39	2.06	3	13.2	0.52	0.24

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 43-D

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: OTTAWA Number: 51001

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air /ug.	BaP per 1000 m^3 Air /ug.
Date 1971	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.[4]		
3/7	59	126.0	2428	51.9	Sat.	NW, SW	2.8	n.a.	1.73	1.45	4	8.1	0.09	0.08
18/7	64	166.0	2133	77.8	Sun.	SW	6.7	0.1	0.97	0.87	4	8.1	0.08	0.07
27/7	68	239.0	2362	101.2	Tue.	W	9.2	0.1	1.75	1.28	4	16.8	0.18	0.13
11/8	72	166.0	2525	65.7	Wed.	W	12.7	0.2	1.47	1.57	4	6.6	0.10	0.10
29/8	78	186.0	2476	75.1	Sun.	W	7.2	0.2	2.39	2.42	4	18.3	0.18	0.18
13/9	83	226.0	2362	95.7	Mon.	NE	10.1	0.1	1.77	1.40	4	15.3	0.17	0.13
28/9	88	391.6	2440	160.5	Tue.	E	7.7	0.4	10.6	6.61	1	n.a.	1.70	1.06
16/10	94	187.7	2387	78.6	Sat.	N	6.6	0.1	4.31	2.60	3	18.3	0.34	0.20
31/10	98	335.2	2362	141.9	Sun.	NE	11.7	0.1	3.58	5.34	3	n.a.	0.51	0.75
15/11	104	220.4	2387	92.3	Mon.	NE	9.1	0.1	16.8	10.8	1	35.7	1.55	1.00
3/12	110	98.7	2415	40.9	Fri.	SW	10.1	0.1	3.34	2.48	4	12.3	0.14	0.10
18/12	115	170.6	2501	68.2	Sat.	NW	7.5	0.1	17.4	17.5	1	34.2	1.19	1.19

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 44-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: OTTAWA Number: 51001

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical 4) D.		
2/1	120	147.6	2508	58.9	Sun.	NE	8.0	0.1	19.5	23.7	2	30.6	1.15	1.40
20/1	126	122.8	2578	47.6	Thu.	N, E	10.3	n.a.	3.52	4.20	2	32.4	0.17	0.20
1/2	130	131.7	2203	59.8	Tue.	W	5.8	0.4	6.69	5.34	3	19.8	0.40	0.32
13/2	134	157.4	2268	69.4	Sun.	NE	11.2	n.a.	13.3	10.5	3+	27.6	0.93	0.73
19/2	136	76.6	1762	43.5	Sat.	NE	16.1	0.2	3.61	3.04	4	10.8	0.16	0.13
8/3	142	135.5	2183	62.1	Wed.	W	18.3	0.2	2.48	1.23	4	10.8	0.15	0.08
23/3	147	48.3	2476	19.5	Thu.	NE	16.0	0.2	6.00	3.12	4	9.6	0.12	0.06
7/4	152	261.8	2142	122.2	Fri.	NW	13.1	0.1	6.51	6.41	1+	50.4	0.80	0.78
22/4	157	639.1	2452	260.6	Sat.	E	10.0	0.3	7.13	2.95	1+	87.6	1.86	0.77
1/5	160	365.6	2203	166.0	Mon.	W	5.2	n.a.	2.95	2.10	1+	39.3	0.49	0.35
25/5	165	438.5	2501	175.3	Thu.	NE	13.1	n.a.	2.58	2.36	2	18.3	0.45	0.41
9/6	170	137.4	2309	59.5	Fri.	N	10.4	0.1	3.89	4.33	3	9.6	0.23	0.26
24/6	174	103.5	2395	43.2	Sat.	E	8.1	0.1	3.37	3.95	3	13.8	0.15	0.17
1/7	176	163.6	2036	80.4	Sat.	SW	5.9	0.1	1.54	1.53	4	9.6	0.12	0.12

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 44-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: OTTAWA Number: 51001

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D. 4)		
30/7	180	91.1	2268	40.2	Sun.	SW	4.1	0.1	2.23	1.08	4	6.6	0.09	0.04
14/8	181	101.7	2162	47.0	Mon.	NE	4.3	0.2	3.14	1.60	4	9.0	0.15	0.08
30/8	183	190.9	2097	91.0	Wed.	W	6.3	0.3	2.08	1.09	4	11.4	0.19	0.10
15/9	185	183.4	2077	88.3	Fri.	SW	6.8	0.3	3.32	1.69	3	24.0	0.29	0.15
1/10	187	86.8	2097	41.4	Sat.	SE	2.9	0.2	26.1	11.9	2	31.8	1.08	0.49
17/10	189	90.9	2203	41.3	Tue.	W	15.0	0.2	5.08	3.74	3	16.8	0.21	0.15
2/11	191	67.9	2228	30.5	Thu.	NE	10.0	0.4	20.9	21.1	2	16.8	0.64	0.64
18/11	193	204.8	2228	91.9	Sat.	N	2.8	0.5	7.98	7.92	1	36.6	0.73	0.73
4/12	195	71.3	2248	31.7	Mon.	NE	9.2	0.4	6.47	7.08	3	15.6	0.21	0.22
20/12	197	67.8	2248	30.2	Wed.	NE	9.4	0.4	13.2	11.5	2	16.2	0.40	0.35

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 44-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: OTTAWA Number: 51001

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			3) Visual a.u.	4) Optical D.		
5/1	199	37.9	2309	16.4	Fri.	W	15.9	0.2	4.04	3.12	4	6.6	0.07	0.05
21/1	201	106.2	2203	48.2	Sun.	NW	4.4	0.3	5.93	5.54	1	24.0	0.29	0.27
6/2	203	114.7	2289	50.1	Tue.	NE	10.4	0.4	4.84	1.62	2	13.8	0.24	0.08
22/2	205	84.8	2309	36.7	Thu.	W	10.4	0.2	12.2	5.67	3	19.8	0.45	0.21
2/3	206	75.1	2248	33.4	Fri.	NE	9.4	0.3	n.a.	n.a.	3	12.0	< .01	< .01
18/3	208	71.2	2248	31.7	Sun.	W	14.4	0.2	6.62	7.52	3	13.2	0.21	0.24
3/4	210	90.2	2248	40.1	Tue.	NE	14.0	0.2	5.44	5.89	3	16.2	0.22	0.24
19/4	212	264.1	2188	120.7	Thu.	NE	7.6	0.2	3.97	3.57	1	27.6	0.48	0.43
13/5	214	87.3	2183	40.0	Sun.	W	11.0	0.1	8.16	3.45	4	11.4	0.33	0.14
27/5	215	155.9	2142	72.8	Sun.	SE	5.0	0.1	4.83	4.51	3	15.6	0.35	0.33
14/6	218	182.2	2183	83.5	Thu.	W	11.1	0.1	3.83	1.45	4	12.6	0.32	0.12
16/7	222	640.3	1966	325.7	Mon.	W	3.1	0.1	5.21	5.68	1+	36.0	1.70	1.85

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 44-D

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: NORTH BAY Number: 75020

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1971	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D.		
4/7	99	175.0	2334	75.0	Sun.	S	6.4	n.a.	13.9	5.27	2	17.4	1.04	0.39
28/7	102	125.9	2289	55.0	Wed.	S	9.6	0.3	4.75	4.02	4	10.2	0.26	0.22
13/8	129	088.4	2505	35.3	Fri.	NE	6.3	n.a.	3.47	1.90	4	9.0	0.12	0.07
28/8	128	138.2	2436	56.7	Sat.	NE	4.7	n.a.	3.73	2.54	4	3.3	0.21	0.14
13/9	130	114.6	2437	47.0	Mon.	N	3.9	0.1	1.84	1.18	4	n.a.	0.09	0.06
29/9	132	111.2	2317	48.0	Wed.	SW	13.1	0.2	6.18	1.63	4	10.8	0.30	0.08
15/10	134	265.0	2387	111.0	Fri.	SW	10.5	0.3	3.02	2.05	3	9.0	0.34	0.23
31/10	136	108.7	2436	44.6	Sun.	SW	18.6	n.a.	5.34	6.22	4	n.a.	0.24	0.28
16/11	138	114.3	2579	44.3	Tue.	SW	0.8	0.3	13.9	5.97	2	23.4	0.62	0.26
2/12	140	61.0	2556	23.9	Thu.	SW	8.9	0.2	5.91	7.82	4	17.4	0.14	0.19
18/12	142	70.6	2505	28.2	Sat.	NW	5.3	0.1	10.7	15.5	2	n.a.	0.30	0.44

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 45-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: NORTH BAY Number: 75020

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1972	Number	Dust mg.	Air m^3	Dust/Air $\mu g./m^3$	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)	$\mu g.$	$\mu g.$	Visual 3) a.u.	Optical D.	$\mu g.$	$\mu g.$
3/1	144	68.3	2554	26.7	Mon.	SW	14.4	0.4	23.7	35.9	2	n.a.	0.63	0.96
19/1	146	55.5	2554	21.7	Wed.	SW	16.0	n.a.	7.45	2.34	4	7.8	0.16	0.05
12/2	149	125.7	2064	60.9	Sat.	SW	10.0	0.5	4.64	2.58	3	12.0	0.28	0.16
20/2	150	74.2	2064	36.0	Sun.	NW	11.5	n.a.	4.88	5.28	3	17.4	0.18	0.19
7/3	152	99.3	2187	45.4	Tue.	E	17.1	0.2	3.92	1.53	4	10.8	0.18	0.07
23/3	106	128.8	2313	55.7	Thu.	N	16.2	0.2	1.85	2.02	2	21.0	0.10	0.11
8/4	107	267.0	2264	117.9	Sat.	N	7.2	0.3	3.58	1.92	2	33.0	0.42	0.23
24/4	109	163.4	2264	72.2	Mon.	N	13.8	0.1	2.34	1.69	2	17.4	0.17	0.12
10/5	111	174.2	2211	78.8	Wed.	SW	9.5	0.1	2.46	1.30	3	16.2	0.19	0.10
24/5	113	191.5	2338	81.9	Wed.	NE	8.9	0.2	1.08	0.64	4	7.8	0.09	0.05
11/6	115	97.5	2211	44.1	Sun.	SW	9.2	0.2	1.40	1.22	4	7.2	0.06	0.05
27/6	117	133.3	2290	58.2	Tue.	SW	4.8	0.1	1.38	1.57	4	n.a.	0.08	0.09
13/7	119	121.4	2289	53.0	Thu.	N	4.0	0.1	1.65	1.25	4	8.4	0.09	0.07

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 1/4 to 1 4.) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 45-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: NORTH BAY Number: 75020

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical D. 4)		
29/7	121	92.6	2264	40.9	Sat.	SW	6.4	0.1	0.68	3.22	4	7.8	0.03	0.14
14/8	123	67.3	2387	28.2	Mon.	NE	9.8	n.a.	1.86	1.00	4	5.5	0.05	0.03
30/8	125	108.9	2211	49.3	Wed.	SW	8.2	n.a.	2.55	1.37	4	8.4	0.13	0.07
16/9	157	97.7	2052	47.6	Sat.	N/SW	8.1	n.a.	2.27	2.61	4	11.4	0.11	0.12
28/9	161	110.7	2313	47.9	Thu.	S	10.7	n.a.	2.59	1.97	4	12.6	0.12	0.09
16/10	167	96.4	2211	43.6	Mon.	SW	19.8	n.a.	3.38	3.14	4	13.8	0.15	0.14
28/10	171	72.2	2211	32.7	Sat.	SW	4.6	n.a.	3.73	3.01	4	13.2	0.12	0.10
12/11	176	65.5	2240	29.2	Sun.	W/SW	4.2	n.a.	1.92	1.21	4	13.8	0.06	0.04
24/11	180	97.1	2313	42.0	Fri.	W	7.3	0.2	3.33	2.29	4	15.0	0.14	0.10
9/12	185	40.6	1987	20.4	Sat.	NNE	2.5	0.4	18.2	15.4	2	16.2	0.37	0.32
20/12	187	41.7	2379	17.5	Wed.	NE	12.0	0.2	6.57	3.09	4	9.0	0.12	0.05

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 45-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: NORTH BAY Number: 75020

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.[4]		
5/1	189	35.3	2313	15.3	Fri.	WNW	14.0	0.1	8.84	5.42	4	7.2	0.14	0.08
21/1	191	54.4	2334	23.3	Sun.	E	4.2	0.2	11.4	5.23	3	16.2	0.27	0.12
6/2	193	37.0	2224	16.6	Tue.	E	10.5	0.3	6.18	3.95	4	9.6	0.10	0.07
22/2	195	73.4	2248	32.7	Thu.	N	5.0	0.5	23.1	27.0	1	28.2	0.76	0.88
2/3	196	91.0	2289	39.8	Fri.	E	7.3	0.3	7.14	5.04	4	7.20	0.28	0.20
18/3	198	103.4	2354	43.9	Sun.	NW	19.4	0.1	5.05	1.93	4	5.40	0.22	0.08
3/4	200	51.8	1966	26.3	Tue.	NE	7.2	0.2	4.80	3.98	4	9.60	0.13	0.10
19/4	202	215.1	2268	94.8	Thu.	E	10.4	0.2	77.5	164.	3	22.2	7.35	15.6
5/5	229	83.3	2052	40.6	Sat.	N	12.3	0.1	10.8	11.7	4	6.0	0.44	0.47
29/5	231	124.7	2007	62.1	Tue.	N	9.5	0.1	30.1	24.0	4	10.8	1.87	1.49
14/6	233	193.9	2117	91.6	Thu.	NW	7.0	0.1	4.99	5.41	4	5.4	0.46	0.50
30/6	235	115.3	2203	52.3	Sat.	SW	4.8	0.2	11.3	11.9	4	9.0	0.59	0.62
16/7	237	101.8	2224	45.8	Mon.	SW	2.2	0.2	20.8	14.3	4	6.	0.95	0.66

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 45-D

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (Hwy. 401) Number: 33002

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust	BaP per 1 gram Dust	Color of Extract		B_kF per 1000 m^3 Air	BaP per 1000 m^3 Air
Date 1971	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)	ug.	ug.	Visual 3) a.u.	Optical D.	ug.	ug.
11/7	65	196.6	2468	79.7	Sun.	N	8.3	n.a.	3.15	0.66	3	13.2	0.25	0.05
20/8	70	314.6	2175	144.6	Fri.	NW	9.0	0.3	2.49	1.69	4	1.8	0.36	0.24
28/8	71	244.8	2130	114.9	Sat.	NNW	7.5	0.2	3.92	2.63	2	28.2	0.45	0.30
13/9	73	237.3	2020	117.5	Mon.	N	11.8	0.5	3.63	3.76	3	n.a.	0.43	0.44
29/9	75	288.2	2199	131.1	Wed.	WNW	11.0	0.4	5.18	1.15	4	n.a.	0.68	0.15
15/10	77	347.6	2132	163.0	Fri.	S	6.8	0.7	3.16	3.87	3	21.0	0.52	0.63
31/10	79	208.9	2219	94.1	Sun.	ESE	8.1	0.3	5.09	4.22	3	n.a.	0.48	0.40
16/11	81	331.2	2199	150.6	Tue.	N	5.9	0.8	5.65	4.44	2	43.2	0.85	0.67
2/12	83	331.5	2109	157.2	Thu.	SW	6.9	0.6	6.92	6.83	2	52.2	1.09	1.07
18/12	85	641.8	2289	280.4	Sat.	NW	12.9	0.3	2.11	3.68	2	n.a.	0.59	1.03

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 1 to 5 4.) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 46-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (Hwy. 401) Number: 33002

TABLE 46-B

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.		
3/1	87	391.7	2264	173.0	Mon.	W	9.6	0.1	2.77	2.61	2	39.6	0.48	0.45
11/1	88	289.6	2264	127.9	Tue.	WSW	10.1	0.2	3.63	5.07	1	n.a.	0.47	0.65
12/2	92	371.1	2346	158.2	Sat.	S	5.3	0.8	14.2	9.07	1	56.4	2.24	1.43
20/2	93	332.4	2371	140.2	Sun.	NW	23.8	0.2	2.15	2.25	2	31.2	0.30	0.32
15/3	95	320.1	2370	135.1	Wed.	ENE	7.0	0.3	1.44	1.20	3	21.0	0.19	0.16
23/3	96	319.0	2166	147.3	Thu.	NW	19.0	0.3	2.73	1.46	2	32.4	0.40	0.21
8/4	98	320.5	2370	135.2	Sat.	NNW	13.4	0.2	3.10	3.52	2	41.4	0.42	0.48
24/4	100	621.9	2142	290.3	Mon.	NNW	8.5	0.4	2.23	3.03	2	n.a.	0.65	0.88
2/5	101	590.3	2317	254.8	Tue.	E	11.0	0.4	2.15	2.29	1+	47.4	0.55	0.58
10/5	102	492.7	2317	212.6	Wed.	NW	12.5	0.3	1.38	0.78	1	34.2	0.29	0.17
11/6	105	205.1	2215	92.6	Sun.	W	8.0	0.1	1.80	2.73	3	n.a.	0.17	0.25
27/6	107	370.2	2011	184.1	Tue.	SW	4.3	n.a.	1.22	1.53	3	n.a.	0.22	0.28
13/7	109	336.4	2089	161.0	Thu.	SW	5.4	0.4	2.35	2.84	2	22.2	0.38	0.46

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4.) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (Hwy. 401) Number: 33002

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical[4] D.		
29/7	111	233.1	2116	110.2	Sat.	SW	3.4	0.3	3.33	3.63	2	21.0	0.37	0.40
14/8	113	355.2	1864	190.6	Mon.	SW	6.7	n.a.	0.45	1.32	4	12.0	0.09	0.25
30/8	114	186.4	1656	112.6	Wed.	SE	3.4	0.2	1.14	0.59	4	8.4	0.13	0.07
15/9	116	209.2	1942	107.7	Fri.	SW	10.2	0.1	2.65	1.55	4	10.8	0.29	0.17
1/10	118	144.4	2020	71.5	Sun.	SW	8.8	0.2	5.74	3.63	2	23.4	0.41	0.26
17/10	120	227.6	2073	109.8	Tue.	W	13.3	0.2	5.35	7.28	1	34.8	0.59	0.80
18/11	123	348.6	2513	138.7	Sat.	W	8.0	0.4	4.18	6.93	1	62.4	0.58	0.96
26/11	124	170.5	2513	67.8	Sun.	SW	24.1	0.2	4.01	1.99	3	19.8	0.27	0.14
12/12	126	364.0	2309	157.6	Tue.	E	10.5	0.6	2.84	2.24	2	38.4	0.45	0.35
28/12	128	511.0	2419	211.2	Thu.	NW	14.8	0.4	1.48	1.16	2	39.0	0.31	0.25

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 46-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: TORONTO (Hwy. 401) Number: 33002

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
5/1	129	355.0	2374	149.5	Fri.	W	22.7	0.3	2.47	3.17	1	39.0	0.37	0.47
21/1	131	172.4	2309	74.7	Sun.	E	14.0	0.3	2.88	1.87	2	19.8	0.22	0.14
6/2	133	691.0	2215	312.0	Tue.	E	20.1	0.4	4.06	2.47	1+	69.6	1.27	0.77
22/2	135	765.3	2374	322.4	Thu.	N	13.4	0.7	2.58	2.56	1+	70.8	0.83	0.83
2/3	136	484.9	2264	214.2	Fri.	E	10.9	1.4	2.43	1.62	2	28.8	0.52	0.35
18/3	138	149.1	1924	77.5	Sun.	NW	25.7	0.2	1.14	0.88	4	9.6	0.09	0.07
3/4	140	259.6	1881	138.0	Tue.	SW	3.6	1.1	2.77	2.24	2	28.2	0.38	0.31
19/4	142	242.8	1901	127.7	Thu.	ENE	12.1	0.6	1.91	1.54	3	15.6	0.24	0.20
5/5	144	206.3	1881	109.7	Sat.	Sev.	16.3	0.3	2.87	3.53	2	28.8	0.32	0.39
29/5	147	281.2	1881	149.5	Tue.	NNW	10.7	0.6	6.48	2.53	4	21.6	0.97	0.38
14/6	149	421.1	1771	237.8	Thu.	NW	9.8	0.7	2.41	0.87	1	23.4	0.57	0.21
22/6	150	278.0	1946	142.9	Fri.	Sev.	4.1	0.9	7.28	7.31	4	19.2	1.04	1.05
16/7	152	174.6	1971	88.6	Mon.	SW	3.2	0.4	16.2	19.2	4	13.8	1.44	1.70

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 46-D

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SARNIA Number: 14051

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust /ug.	BaP per 1 gram Dust /ug.	Color of Extract		B_kF per 1000 m^3 Air /ug.	BaP per 1000 m^3 Air /ug.
Date 1971	Number	Dust mg.	Air m^3	Dust/Air /ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual a.u.[3]	Optical D.		
3/7	99	213.8	2330	91.8	Sat.	SE	5.5	0.3	1.21	0.17	4	10.8	0.11	0.02
19/7	101	169.1	2521	67.1	Mon.	NW	9.9	0.2	2.17	0.40	4	10.2	0.15	0.03
27/7	102	202.8	2440	83.1	Tue.	S	7.1	0.2	1.98	1.59	4	7.8	0.16	0.13
12/8	104	226.2	2305	98.1	Thu.	S	6.8	0.4	3.28	2.05	3	n.a.	0.32	0.20
28/8	106	182.7	2411	75.8	Sat.	W	7.5	0.2	1.37	0.99	4	9.6	0.10	0.07
13/9	108	215.5	2411	89.4	Mon.	NW	11.5	0.1	1.12	0.37	4	n.a.	0.10	0.03
29/9	110	324.3	2411	134.5	Wed.	n.a.	10.9	0.3	0.76	0.37	4	n.a.	0.10	0.05
15/10	112	544.4	2440	223.1	Fri.	SE	6.8	0.8	1.49	1.24	2	11.4	0.33	0.28
31/10	114	257.9	2521	102.3	Sun.	SW	10.6	0.4	2.48	2.28	2	14.4	0.25	0.23
16/11	116	362.4	2493	145.4	Tue.	W	6.7	0.3	1.63	1.61	2	n.a.	0.24	0.23
2/12	118	198.4	2442	81.2	Thu.	SW	7.6	0.5	6.21	8.76	2	n.a.	0.50	0.71
18/12	120	140.4	2358	59.5	Sat.	W	11.9	0.4	2.40	1.61	4	13.2	0.14	0.10

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4.) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract

TABLE 47-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SARNIA Number: 14051

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual a.u. 3)	Optical D.		
3/1	122	116.5	2493	46.7	Mon.	SW	7.4	0.3	5.76	5.07	3	16.8	0.27	0.24
19/1	124	103.0	2268	45.4	Wed.	W	11.8	0.4	4.74	2.15	4	12.6	0.22	0.10
4/2	126	106.4	2334	45.6	Fri.	W	19.9	0.3	3.25	0.64	4	8.4	0.15	0.03
12/2	127	579.4	2464	235.1	Sat.	SE	8.5	1.2	6.58	3.08	2	34.2	1.55	0.72
20/2	128	184.1	2509	73.4	Sun.	NW	13.7	0.2	1.20	0.97	4	10.2	0.09	0.07
7/3	130	122.8	2534	48.5	Tue.	S	21.3	0.4	3.54	1.16	3	12.6	0.17	0.06
23/3	132	120.3	2399	50.1	Thu.	NW	20.4	0.2	2.17	0.59	3	10.8	0.11	0.03
6/4	134	358.0	2444	146.5	Thu.	NW	10.5	0.2	1.01	0.68	3	18.0	0.15	0.10
27/4	137	337.0	2379	141.7	Thu.	NW	6.2	0.3	1.25	0.72	3	22.2	0.18	0.10
1/5	14049 -468	313.3	2464	127.2	Mon.	SE	8.4	0.5	2.67	1.75	2	18.0	0.34	0.22
2/5	14049 -468	502.2	2224	225.8	Tue.	S	10.6	0.5	2.63	1.43	1+	36.0	0.59	0.32
9/5	139	179.4	2399	74.8	Tue.	NW	13.0	0.2	1.50	0.26	4	12.0	0.11	0.02
8/6	144	325.6	2240	145.4	Thu.	SW	6.9	0.7	1.64	1.40	3	14.4	0.24	0.20
26/6	147	173.0	2101	82.3	Mon.	NW	5.7	0.3	0.95	0.69	3	n.a.	0.08	0.06
14/7	150	323.0	2183	150.0	Fri.	S	10.3	0.5	0.90	0.80	3	10.2	0.13	0.12

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract

TABLE 47-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SARNIA Number: 14051

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			3) Visual a.u.	4) Optical D.		
26/7	152	337.2	2015	167.3	Wed.	NW	6.0	0.14	0.59	0.48	2	15.6	0.10	0.08
25/8	156	197.7	2175	90.9	Fri.	n.a.	n.a.	0.39	0.49	0.27	4	6.6	0.04	0.02
12/9	160	299.0	2150	139.1	Tue.	NW	5.2	0.30	0.99	0.40	4	6.6	0.14	0.06
6/10	164	215.8	1966	109.8	Fri.	NW	6.9	n.a.	1.90	1.15	4	9.0	0.21	0.13
18/10	166	151.7	2105	72.1	Wed.	NW	10	n.a.	2.52	1.28	4	13.8	0.18	0.09
30/10	168	259.5	2419	107.3	Mon.	N	5	n.a.	1.50	1.36	3	27.6	0.16	0.15
29/11	172	361.7	2215	163.3	Wed.	WSW	7	n.a.	6.03	4.85	1+	44.4	0.99	0.79
11/12	174	121.4	2354	51.6	Mon.	WSW	4	n.a.	9.36	6.87	2	26.4	0.48	0.36
23/12	176	203.8	2309	88.3	Sat.	S	6	0.5	3.26	2.36	3	13.8	0.29	0.21

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 47-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SARNIA Number: 14051

TABLE 47-D

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual 3) a.u.	Optical 4) D.		
4/1	178	83.5	2240	37.3	Thu.	SSW	20	0.3	5.00	2.30	4	9.0	0.19	0.09
22/1	181	118.6	2354	50.4	Mon.	SSE	16	0.2	5.78	3.45	4	10.2	0.29	0.17
15/2	185	86.2	2354	36.6	Thu.	N	17	n.a.	1.22	0.71	4	4.8	0.04	0.03
27/2	187	187.3	2285	82.0	Tue.	NE	9	n.a.	2.74	1.84	3	13.2	0.22	0.15
5/3	188	111.4	2285	48.8	Mon.	E	11	0.3	2.73	0.54	4	11.4	0.13	0.03
23/3	191	366.4	2240	163.6	Fri.	N	5	0.4	1.30	0.04	2	29.4	0.21	0.01
10/4	194	80.1	2264	35.4	Tue.	W	15	0.3	2.47	2.25	4	5.40	0.09	0.08
4/5	197	211.4	2240	94.4	Fri.	N	13	0.3	4.80	3.07	4	9.0	0.45	0.29
16/5	199	396.5	2195	180.6	Wed.	WSW,NNE	17	0.4	28.7	23.9	3	19.8	5.18	4.31
3/6	202	162.7	2150	75.7	Sun.	SSW	11	0.2	6.31	3.73	3	11.4	0.48	0.28
15/6	204	380.4	2011	189.2	Fri.	WSW	9	0.6	2.38	2.58	3	10.8	0.45	0.49
27/6	206	243.4	1991	122.3	Wed.	WSW	11	0.2	1.73	1.38	3	8.4	0.21	0.17
3/7	207	173.0	1901	91.0	Tue.	WSW	11	0.3	1.53	1.52	4	8.4	0.14	0.14
15/7	209	118.4	2242	52.8	Sun.	NE	8	0.1	6.86	10.2	4	5.4	0.36	0.54
21/7	210	220.2	1585	138.9	Sat.	ENE	9	0.1	0.63	0.25	4	13.2	0.09	0.04

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SUDBURY Number: 77016

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1971	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.		
3/7	135	162.3	2224	73.0	Sat.	SW	11.8	0.2	0.77	0.39	4	8.4	0.06	0.03
18/7	138	413.2	2260	182.8	Sun.	W	11.1	0.03	0.37	0.25	4	6.6	0.07	0.05
5/8	143	165.3	2224	74.3	Thu.	W	8.9	0.1	0.39	0.28	4	4.2	0.03	0.02
20/8	148	99.5	2509	39.7	Fri.	NW	9.4	0.2	0.37	0.12	4	4.8	0.01	<0.01
1/9	152	141.2	2268	62.3	Wed.	S	8.6	0.3	1.25	1.29	3	8.4	0.08	0.08
16/9	160	86.4	1975	43.7	Thu.	SW	7.9	0.3	0.75	0.25	4	4.8	0.03	0.01
1/10	162	180.8	2224	81.3	Fri.	S	14.2	0.4	0.91	0.26	4	6.0	0.07	0.02
10/10	165	152.5	2138	71.3	Sun.	SW	8.8	0.2	0.59	0.23	4	6.0	0.04	0.02
28/10	168	189.1	2024	93.4	Thu.	SW	17.8	0.2	1.01	0.37	4	10.8	0.09	0.03
12/11	173	171.5	2093	81.9	Fri.	N	6.3	0.2	1.96	0.85	4	12.0	0.16	0.07
24/11	175	163.5	2093	78.1	Wed.	SE	14.0	0.3	1.68	0.93	4	9.6	0.13	0.07
6/12	178	102.5	2113	48.5	Mon.	SE	7.6	0.5	4.46	2.57	2	10.2	0.22	0.12
18/12	182	109.1	2093	52.1	Sat.	N	10.8	0.3	2.74	1.82	4	8.4	0.14	0.10

1) M.P.H. 2) Coefficient of Haze 3) Increasing from ¼ to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 48-A

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SUDBURY Number: 77016

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust µg.	BaP per 1 gram Dust µg.	Color of Extract		B_kF per 1000 m^3 Air µg.	BaP per 1000 m^3 Air µg.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air µg./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed 1)	COH Value 2)			Visual a.u. 3)	Optical D.		
5/1	187	183.6	2137	85.9	Wed.	N,SE,S	8.0	0.30	3.12	1.56	2	15.6	0.27	0.13
19/1	190	76.1	2354	32.3	Wed.	W	20.3	0.10	6.25	4.75	2	12.6	0.20	0.15
1/2	194	153.7	2248	68.4	Tue.	NE	7.8	0.20	1.71	0.80	3	12.0	0.12	0.05
19/2	200	124.8	2485	50.2	Sat.	N	22.0	n.a.	0.91	0.44	4	6.6	0.05	0.02
8/3	206	83.9	2574	32.6	Wed.	NW	16.7	0.03	1.19	0.38	4	8.4	0.04	0.01
20/3	210	89.0	2574	34.6	Mon.	SE	6.4	0.20	7.33	19.3	4	5.4	0.25	0.67
10/4	216	124.1	2191	56.6	Mon.	SW	12.0	0.10	0.86	0.73	4	7.8	0.05	0.04
25/4	221	147.5	2215	66.6	Tue.	N	9.3	0.10	1.18	0.22	3	n.a.	0.08	0.01
25/5	228	187.5	2215	84.7	Thu.	SE	10.2	0.10	1.04	0.90	4	9.6	0.09	0.08
9/6	233	144.5	1958	73.8	Fri.	N	22.6	0.03	0.18	0.71	4	7.2	0.01	0.05
24/6	238	74.9	2215	33.8	Sat.	NE	16.3	0.10	0.53	0.79	4	4.8	0.02	0.03
9/7	243	189.9	1844	102.9	Sun.	S	11.5	0.10	1.16	1.70	4	8.4	0.12	0.17

1) n.v.

2) Coefficient of Haze

3) Increasing from 1 to 4

4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 48-B

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SUDBURY Number: 77016

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1972	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.[4]		
27/7	249	138.0	1958	70.5	Thu.	NW	8.7	0.2	1.49	1.92	4	7.2	0.10	0.14
11/8	254	101.7	2142	47.5	Fri.	SW	15.5	0.05	1.11	1.02	4	7.2	0.05	0.05
26/8	259	93.2	1934	48.2	Sat.	E	10.9	0.01	1.17	0.92	4	8.4	0.06	0.04
10/9	264	131.0	2064	63.5	Sun.	SW	12.5	0.02	1.06	0.93	4	9.6	0.07	0.06
28/9	270	83.0	2244	37.0	Thu.	S	15.0	0.1	2.15	2.25	4	9.6	0.08	0.08
10/10	274	78.5	2040	38.5	Tue.	S	15.5	0.1	3.83	2.53	4	10.8	0.15	0.10
25/10	279	97.0	1775	54.7	Wed.	S	13.1	0.05	3.28	2.34	4	7.8	0.18	0.13
9/11	284	137.1	2044	67.1	Thu.	N	13.5	0.1	2.70	1.90	4	15.6	0.18	0.13
24/11	289	315.6	1958	161.2	Fri.	W	11.1	0.1	0.59	0.34	4	10.8	0.09	0.05
9/12	294	58.2	2093	27.8	Sat.	N	9.3	0.1	3.74	2.79	4	12.0	0.10	0.08
24/12	299	40.4	1958	20.6	Sun.	NE	13.7	0.1	2.35	2.23	4	7.2	0.05	0.05

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 48-C

AIR QUALITY LABORATORY

Benzo(k)Fluoranthene and Benzo(a)Pyrene on Hi-Vol Filters

Station: SUDBURY Number: 77016

Hi-Vol Filter					Sampling Conditions				B_kF per 1 gram Dust ug.	BaP per 1 gram Dust ug.	Color of Extract		B_kF per 1000 m^3 Air ug.	BaP per 1000 m^3 Air ug.
Date 1973	Number	Dust mg.	Air m^3	Dust/Air ug./m^3	Sampling Day	Prevail. Wind Direction	Average Wind Speed[1]	COH Value[2]			Visual[3] a.u.	Optical D.[4]		
4/1	304	40.0	1934	20.7	Thu.	W	16.0	0.1	4.81	5.49	4	8.4	0.10	0.11
19/1	309	99.2	2093	47.4	Fri.	S	19.0	0.2	3.39	2.96	3	10.8	0.16	0.14
6/2	315	55.3	1958	28.2	Tue.	E/SE	6.2	0.2	5.75	7.95	3	14.4	0.16	0.22
21/2	320	63.6	1909	33.3	Wed.	NE	11.5	0.1	4.86	4.80	3	13.8	0.16	0.16
2/3	323	100.0	1918	52.1	Fri.	E	9.4	0.2	1.97	1.68	4	10.8	0.10	0.09
17/3	328	174.6	1979	88.2	Sat.	N	35.4	0.03	0.77	0.48	4	6.0	0.07	0.04
1/4	333	98.1	1938	50.6	Sun.	NE	19.3	0.1	1.07	0.69	4	5.4	0.05	0.04
19/4	339	229.7	1938	118.5	Thu.	NE	12.7	0.03	1.46	1.74	3	14.4	0.17	0.21
4/5	344	49.1	2028	24.2	Fri.	N	19.9	0.04	2.79	1.24	4	7.2	0.07	0.03
19/5	349	115.9	1958	59.2	Sat.	W	6.7	0.05	1.89	0.33	4	4.2	0.11	0.02
3/6	354	169.2	2162	78.3	Sun.	SE	11.4	0.1	2.75	0.83	4	11.4	0.22	0.06
18/6	362	89.1	2011	44.3	Mon.	W	5.3	0.1	2.87	1.52	4	7.8	0.13	0.07
3/7	369	183.4	2056	89.2	Tue.	SW	13.0	0.03	1.67	2.47	4	4.2	0.15	0.22
18/7	374	222.0	1877	118.3	Wed.	SW	14.1	0.1	2.41	1.24	4	7.2	0.28	0.15

1) M.P.H. 2) Coefficient of Haze 3) Increasing from 4 to 1 4) O.D. per 1000 m^3 air in 1.0 ml cyclohexane extract.

TABLE 48-D

SPECIAL STUDIES

1) City Traffic and PAH Level

In this survey, the Toronto Station No. 33002 at the intersection of Highway 401 and Pharmacy Street had been selected for investigating the influence of motor-car traffic upon PAH-pollution levels. As discussed in the Chapter on "Station Location and PAH Level" and as shown graphically in Figures 27-A and 27-B, the BaP and BkF levels at this street-level location remained relatively low throughout the entire two-year survey. Although it had been found that the average speed of winds from the general direction of a pollution source had little influence on pollution levels, it seemed possible that turbulent movements from different directions at the generally wind-swept and open intersection may have caused a dispersing effect which prevented any higher concentration of pollutants at this location.

As a more sheltered mid-city location with heavy traffic, the corner of Bay and Grosvenor Streets was selected by Air Resources Branch for High-Volume filter sampling at street level, over the usual 24-hour periods, in December 1973 and in June/July 1974. The analytical results for both sampling periods, shown in Table 49, indicated two to three times higher BaP and BkF levels at this central location than at Highway 401 (Tables 46-A and 46-B) although the PAH levels never reached excessively high levels. Dust levels at this location, however, were found to be lower than at the Highway 401 intersection, which may have to be credited to efficient street cleaning in downtown Toronto.

TABLL 49

BaP and BkF Levels on Bay Street, Toronto

Date Dec. 1973	Filter Number	Dust ug/m^3 Air	BaP ug/1000m^3 Air	BkF ug/1000m^3 Air
4	0-001	79.9	1.77	1.20
5	0-002	130.7	1.57	2.59
6	0-003	89.0	1.38	1.10
7	0-004	93.7	1.41	2.13
8	0-005	103.9	1.68	1.18
9	0-006	58.0	0.25	1.03
10	0-007	107.1	1.41	2.50
11	0-008	104.5	1.71	1.18
12	0-009	147.9	2.78	7.79
13	0-010	89.8	1.31	2.80
14	0-011	35.5	0.45	0.70
15	0-012	65.0	0.92	0.83
16	0-013	50.8	0.81	0.84
17	0-014	85.6	0.53	0.65
18	0-015	89.6	1.67	1.22
19	0-016	57.2	1.76	1.18
20	0-017	15.8	1.22	1.37
21	0-018	34.6	0.59	0.58
22	0-019	45.6	0.95	1.08
23	0-20	41.0	0.61	0.72
24	0-021	36.4	0.56	0.76
25	0-022	52.6	0.92	1.11
26	0-023	45.0	2.01	1.67
	Average (23 days):		1.23	1.57

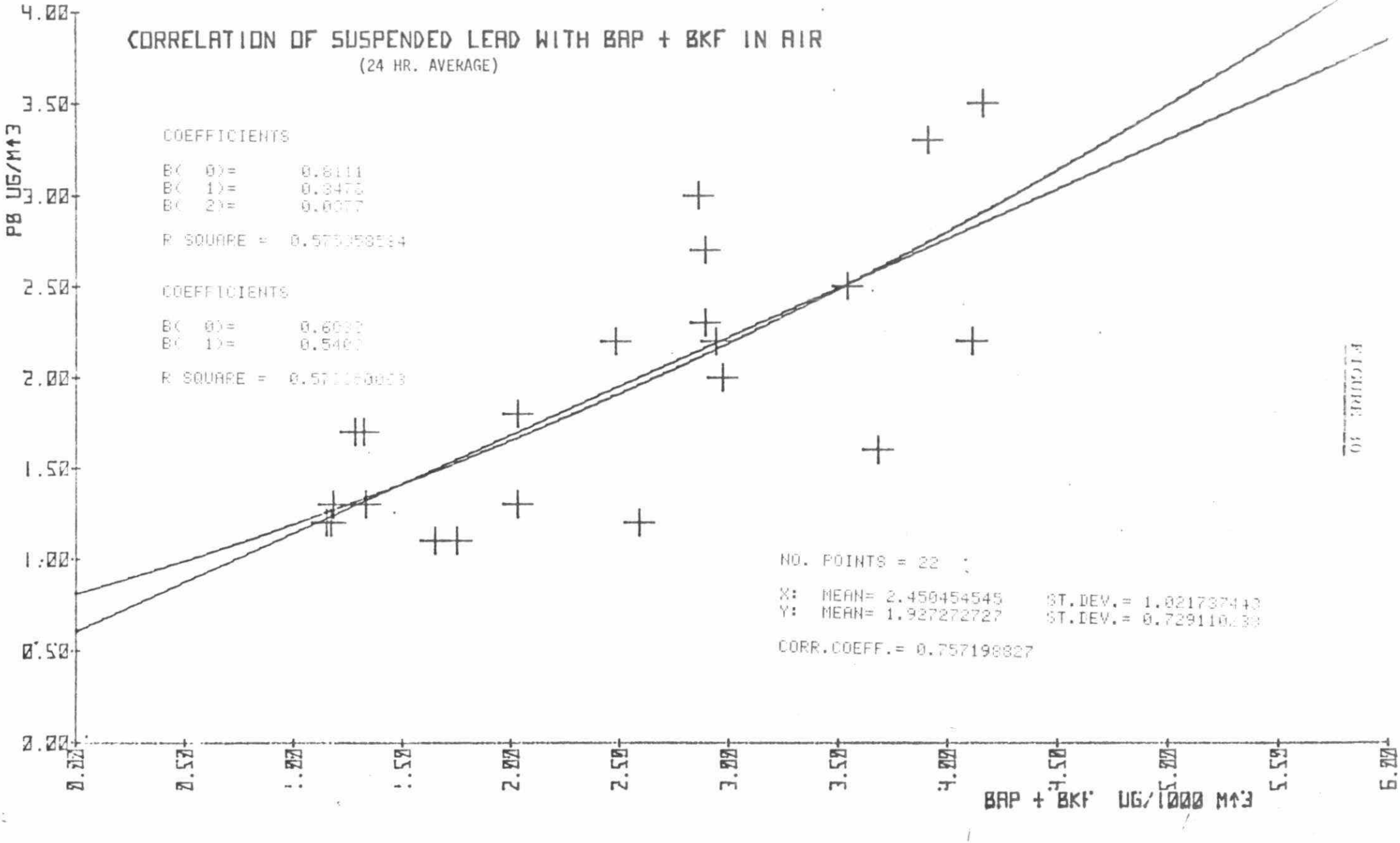

CORRELATION OF SUSPENDED LEAD WITH BAP + BKF IN AIR
(24 HR. AVERAGE)
COEFFICIENTS
B(0)= 0.8111
B(1)= 0.3476
B(2)= 0.0077
R SQUARE = 0.575358564
COEFFICIENTS
B(0)= 0.6032
B(1)= 0.5402
R SQUARE = 0.571660863
NO. POINTS = 22
X: MEAN= 2.450454545 ST.DEV.= 1.021737443
Y: MEAN= 1.927272727 ST.DEV.= 0.729110239
CORR.COEFF.= 0.757198827
PB UG/M^3
BAP + BKF UG/1000 M^3
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00

FIGURE 30

From the data in Table 49, Technology Development and Appraisal Section were able to show (52) that a reasonably linear correlation existed between the BaP and lead concentrations in these air samples (Figure 30). With the evidence indicating that the lead originated almost exclusively from motor-car emissions, the conclusion was drawn that most of the BaP too originated from the same source.

2) Particle Size and PAH Level

In attempts at determining the particle size of BaP and BkF (or the size of the airborne particulate on which the PAH compounds may be adsorbed), Andersen filter samples taken at the location at Bay and Grosvenor Streets were analyzed for BaP and BkF. Two sets of these Andersen filter samples were selected for analysis from two sampling days on the basis of relatively high particulate or dust loadings in order to ensure sufficient sample size for analysis.

Analysis of the first (coarse) filters and of the back-up (fine) filters was aimed at determining whether the PAH-containing particles are large enough to be retained by the coarse filters (pore size 7 um) or whether they would pass through to the back-up filter (<1.1 um).

Inspection of the Andersen filter samples revealed that the dust had collected almost exclusively on the first (top) filter, containing the largest pores, and on the last

(back-up) filter with the smallest pores. The amount of dust on the three filters in between appeared to be too small for BaP and BkF analysis and, therefore, was ignored in these experiments.

TABLE 50

BaP and BkF Distribution with Particle Size

Date (1973)	Filter Number	Dust ug/m^3 Air	BaP ug/1000 m^3 Air	BkF ug/1000 m^3 Air	BaP % on Filter	BkF % on Filter
5/12	4-1-001 (First Filter)	75.5	0.22	0.18	23	11
5/12	44-1-026 (Last Filter)	44.9	0.73	1.39	77	89
18/12	44-1-026 (First Filter)	67.5	0.11	0.15	7	6
18/12	44-5-030 (Last Filter)	43.3	1.44	2.50	93	94

The results in Table 50 indicate that the majority (about 80 to 90%) of BaP and BkF containing particles were smaller than 1.1 um, the pore size of the second to the last filter. By implication, most other PAH compounds may have had a similar particle-size distribution and thus, may have been present in airborne particulate of predominantly small particle sizes.

The results of these experiments were in excellent agreement with a more extensive, recent study on PAH content and size distribution of atmospheric aerosols (53), which also showed the greatest concentration of PAH being in the respirable, small-size range.

3) Roof-Tarring and PAH Level

A major roof-tarring operation was conducted during the summer months of 1975 in Toronto where the back alley of 880 Bay Street at street level served as the base for the hot tar preparation. After setting up a High-Volume Sampler, Technology Development & Appraisal Section obtained High-Volume filter samples in the immediate vicinity of this activity, which were used for briefly investigating the levels of BaP and BkF in the surrounding atmosphere.

The results of the analyses, shown in Table 51, indicated excessively high levels of PAH generated from this

tarring operation. The BaP and BkF levels at that site had risen up to about 750 times over the average levels recorded at the nearby College Street Station, #31001. Of course, extremely high PAH levels during similar activities have frequently been reported in the literature (15). Perhaps the highest BaP levels were reported in 1965 with 78,000 ug BaP/ $1000m^3$ air being claimed from a road-tarring operation (54).

TABLE 51

BaP and BkF Levels during Tarring Operation

(August 1975)

Filter Number	Air Volume $1000m^3$	BaP ug/$1000m^3$ Air	BkF ug/$1000m^3$ Air
1 - 880 Bay	1.2233	1.03	4.17
2 - 880 Bay	1.2233	421.7	563.5
3 - 880 Bay	0.6881	128.4	253.6
4 - 880 Bay	1.835	172.8	236.6
5 - 880 Bay	0.2039	146.9	210.8

4) Fire in City and PAH Level

During a fire on Weston Road in Toronto on March 4th and 5th, 1975, High-Volume filter samples had been taken at the neighbouring stations, #31026, #31063 and #31066. In order to establish the effect of this fire on the PAH levels in

TABLE 52

BaP and BkF Levels in Toronto During Fire

Date (1975)	Station Number	Filter Number	BaP ug/1000m^3 Air	BkF ug/1000m^3 Air
	Adjacent Stations			
March 4	31026	843	4.14	4.84
"	31063	457	4.64	5.85
"	31066	433	1.46	1.54
March 5	31026	844	3.39	5.70
"	31063	458	4.63	5.09
"	31066	434	0.51	0.66
Adjacent Stations-Two Day Average			3.13	3.95
	Reference Station			
March 4	31001	140	0.22	0.81
March 5	31001	141	0.55	0.91
Reference Station-Two Day Average			0.38	0.86
Reference Station-Two Yr. Average			0.58	0.73

the surrounding air, High-Volume filter samples from these Stations and, for comparison, from a more remote city location (on College Street) were analyzed for BaP and BkF.

Results of these analyses, shown in Table 52, indicate that during the two-day period the average BaP and BkF levels had increased eight and five-fold, respectively, at the Stations close to the fire over the levels at the "Reference" Station on College Street.

5) BaP and BkF Levels in Vicinity of Steel Plant

According to data obtained in Sault Ste. Marie, Station #71021, for the first year of the survey (Table 12 and Figure 22-A), only low BaP and BkF levels were recorded in spite of the presence of the Algoma Steel Corporation in this city. In the second year of the survey, however, these levels showed two high peaks with up to 22.5 and 34.0 ug/1000m^3, respectively, for these compounds.

In order to investigate whether the Algoma Steel Corporation would have been responsible for these occasional high levels recorded at Station #71021, and whether from this steel plant high emissions of PAH could be occurring more frequently than was suggested by the readings of the above Station, a programme of High-Volume filter sampling was conducted downwind and in the direct vicinity of this company.

TABLE 53

BaP and BkF Levels at Algoma Steel, Sault Ste. Marie

Station Number	Filter Number	Date 1975	Dust ug/m^3 Air	BaP ug/1000m^3 Air	BkF ug/1000m^3 Air
71000	51*	24/1	391	152	216
"	52	24/1	168	43.2	61.6
"	53	28/1	93	13.2	20.3
"	56	29/1	146	11.2	26.9
"	61	1/2	125	1.38	5.59
"	62	1/2	123	2.50	2.61
"	65	4/2	103	26.6	42.1
"	66	4/2	128	27.7	43.0
33006	13	3/2	175	6.57	57.1
"	14	3/2	183	31.8	63.8
Downwind from Algoma Steel, Average:			163.5	31.6	53.9
"Reference" Filters					
71000	54	28/1	18	0.21	0.39
"	57	30/1	24	0.56	0.96
"	59	31/1	9	0.22	0.25
Three-Day Average:			17	.33	.53
Station #71021, Two-Year Average:			66	0.98	1.75

* This High-Volume filter had been exposed to only 1/10 of the regular air volume (224m^3 compared to approximately 2200m^3 air exposure during the customary 24-hour sampling period).

The sampling was done by the Mobile Unit of Technology Development & Appraisal Section of the Air Resources Branch in January and February 1975. The results of the BaP and BkF analyses are shown in Table 53, indicating levels which were among the highest recorded in Ontario since the start-up of this survey. These levels, on an average basis, amounted to about 30 and 100 times the BaP and BkF levels upwind from the steel plant. The dust levels were found to follow a similar pattern.

6) BaP and BkF Analyses not Included in this Report

Some investigations and data obtained after the end of 1973 from Stations discussed in this report were not included in this two-year report. They comprise work being done after the inception of the Air Quality Survey Plans of the Regions in which these Stations are located, such as Station #27027 in Welland and Station #71021 in Sault Ste. Marie.

Other Stations presently investigated under the new Survey Plans include Station #27028, #27009, #27013, #27014, #27015, #27016, #27033 and #27034. Summary reports on the results from this work are periodically submitted to the corresponding Regions for their evaluation, and to the Air Quality & Meteorology Section for inclusion in their central files.

Special short term investigations on BaP and BkF levels at certain industrial sites were also carried out after the end

of the two-year survey. These included studies in the close proximity of Union Carbide Company, Welland; Norton Abrasives Company, Chippawa; General Abrasives Company, Niagara Falls, which were initiated and evaluated by Air Resources Branch.

7) Examples of PAH Levels in Other Countries

In order to permit some comparison of the BaP levels observed in this survey for urban communities in Ontario with those of foreign countries, the following are some randomly selected examples from the literature:

City	Sampling Period	BaP ug/1000m^{3}Air (Means or Range)	Reference
(North America)			
Berkley	Winter 1959	2.9	55
Boston	Winter 1959	9.6	55
Chicago	Winter 1959	15	55
Cleveland	Winter 1959	24	55
Dallas	Winter 1959	1.4	55
Las Vegas	Winter 1959	1.4	55
Los Angeles	Winter-Spring 1966	2.2	56
Miami	Winter 1959	1.9	55
Pittsburg	Winter 1959	5.1	55
New York	Winter-Spring 1966	3.2	56
Salt Lake City	Winter 1959	0.5	55
San Diego	Winter 1959	2.1	55
Seattle	Winter 1959	9.0	55
Washington	Winter 1959	9.3	55
Detroit	Spring 1959	7-16	59
Rochester	Spring 1967	0.1	60

cont'd:

City	Sampling Period	BaP ug/1000m^3 Air (Means or Range	Reference
Tulsa	Winter 1959	1.0	55
San Juan, Puerto Rico	Winter 1959	1.2	55
Mexico City	Summer 1966	0.41	57
Mexico City	Winter 1966	1.15	57
Mexico City	December 1968	3.2(U.S. Eval)	57
Mexico City	December 1968	29.4(Can. Eval)	57
(Europe)			
Paris	Jan. to May 1969	0.6-225.7	57
Hamburg	Spring 1963	17-124	58
Milan	Jan. to Oct. 1958	231	59
Oslo	Summer 1963	0.5	60
Oslo	Winter 1963	14	60
Belfast	Summer 1961	9	60
Belfast	Winter 1961	51	60
Dublin	Summer 1961	3	60
Dublin	Winter 1961	23	60
Helsinki	Summer 1963	1.6	60
Helsinki	Winter 1963	5	60
Budapest	Summer 1960	32.2	61
Budapest	Winter 1960	1060	61
Teheran	July 1971	0.6-0.7	62
Teheran	Nov. 1971	4.9-7.5	62
Tokyo	Summer-Fall 1973	28.6	64
(South Africa)			
Pretoria	Aug. 1963 (Winter)	22	63
Pretoria	Sept. 1963 "	28	63
Pretoria	Jan. 1964 (Summer)	10	63
Johannesburg	Apr. 1964 (Winter)	22	63
Johannesburg	May 1964 "	49	63
Johannesburg	May 1964 (Road-Tarring)	1113	63
Durban	June 1964 (Winter)	9	63

It appears from these data that the BaP levels in the industrial communities of Welland, Windsor (Detroit proximity) and Hamilton are of a similar order of magnitude as the levels in heavily industrialized communities of foreign countries. The "non-industrial" urban communities in Ontario - as surveyed in this study - seem to compare favourably with similar communities in foreign countries.

A note of caution in accepting the above data quoted from the literature may be in order: The analytical methods used were not always clearly defined in these references and may not necessarily meet presently accepted standards in all cases. Some of the older references may have used u.v.-absorption techniques for determining BaP which could have given high results.

CONCLUSIONS AND RECOMMENDATIONS

In accordance with the objectives of this work, as outlined on page 2 of this report, analytical methods suitable for determining and monitoring important PAH compounds on High-Volume filters have been developed. By using these methods, a comprehensive two-year survey programme for measuring BaP and BkF in urban atmospheres in Ontario was initiated and carried through to completion.

Conclusions reached from the analytical results were already stated in the discussions of the data in the body of this report. In order to highlight the essential findings of this project, only those which appeared to be of particular significance, or seemed new, or would require continued or immediate attention are listed here together with recommendations for further action as considered advisable from the data presented. This should not be taken as an attempt to list all correlations, inferences and implications which might be deducible from the mass of data collected in this survey.

1) Welland

Of the ten urban communities investigated, Welland was found to have by far the highest PAH levels. In the first survey year, the average BaP and BkF levels were 8.07 and 19.8 ug/1000m^3 air, respectively, and the corresponding maximum levels - the highest in the entire survey - were 116 and 176 respectively.

In the second year, the average BaP and BkF levels were 5.07 and 19.46 ug/1000m^3 air, which are similar to those of the first year, while the maximum levels were found to be lower at 54.8 and 138 ug/1000m^3 air, respectively. Over the entire two-year period of this survey, the average BaP and BkF levels were 5.98 and 19.57 ug/1000m^3 air, respectively; these average levels were about 10 to 27 times higher than the corresponding levels in downtown Toronto (College Street). Concurrent with the high PAH levels at Welland, record high levels of total suspended particulate matter ("dust") were also found for both the average level (233.3 ug/m^3 air) and the maximum level (1716.8 ug/m^3 air) during the two-year period.

There is considerable evidence that the Union Carbide Company was the prime source of these emissions in Welland. Since 1973, the Stations # 27027, # 27028, # 27009, # 27013, # 27014, # 27015, # 27016, # 27033 and # 27034 have been established as part of the West-Central Regional Air Quality Survey Plan for the purpose of intensifying the surveillance at Welland and its surroundings. Continued surveillance of suspected sources of PAH emissions in Welland is recommended and means should be sought to reduce the levels of these emissions. Such reduction could proceed stepwise over certain periods of time.

2) Hamilton and Sault Ste. Marie

The steel plants in Hamilton and Sault Ste. Marie were most likely sources for major PAH emissions. High BaP and BkF levels were frequently recorded just east of Hamilton's steel mills with prevailing west winds. The average levels of these pollutants during the first year were 1.86 and 2.56 ug/1000m^3 air,

respectively, while the levels were significantly higher during the second year at 2.94 and 4.83 ug/1000m^3 air, respectively. Similarly, the maximum levels for BaP and BkF increased from 9.38 and 9.59 ug/1000m^3 air in the first year to 23.4 and 45.7 ug/1000m^3 air, respectively, in the second year. Thus, steep increases of average as well as maximum levels from the first to the second survey year became evident at Hamilton.

In Sault Ste. Marie, at Station # 71021, there were more moderate levels for BaP and BkF recorded with the exception of one steep rise of these levels in the second year when 22.5 and 34.0 ug/1000m^3 air, respectively, were reached. However, persisting high PAH levels were found in a recent study when the sampling was done in the direct vicinity of and downwind from the Algoma Steel Plant in Sault Ste. Marie.

Continuing and tight surveillance of PAH emissions from the steel plants in both cities seems advisable. In Hamilton, the Columbian Carbon (Canada) Company also deserves special attention regarding these emissions. Regional Air Quality Survey Plans already include the Stations # 29008 and # 71021 for monitoring PAH levels on regular schedules, but other locations closer to suspected emission sources as well as in residential areas in these cities should be considered. Introduction of tight controls of PAH emissions from these plants may become necessary.

3) Windsor

Under the influence of prevailing winds from the direction of neighbouring Detroit, the air in Windsor showed frequently high PAH levels during both years of the survey. The two-year averages of BaP and BkF levels were 2.19 and 4.14 ug/1000m^3 air, respectively, with maximum levels at 35.4 and 73.4 ug/1000m^3 air.

In view of the high pollution levels it seems reasonable to continue surveillance at sites in Windsor, including a Station located near the centre of the city, such as Station # 12008 which had been selected for this survey. Keeping a record of pollution levels, wind direction and other related data for Windsor may prove important and may provide essential data for pinpointing the specific sources of transboundary pollution.

4) Toronto and Ottawa

The PAH levels at the Stations in Toronto and Ottawa were low to moderate except during periods of temperature inversions. While during such periods, the BaP and BkF levels in downtown Toronto rose to 4.27 and 4.38 ug/1000m^3 air, respectively, the two-year averages were only 0.58 and 0.73 for these two pollutants. In Ottawa, the corresponding maximum levels were 1.85 and 1.86 ug/1000m^3 air, and the two-year averages 0.37 and 0.46, respectively.

Although the PAH levels in these two city locations, termed "residential and business", were clearly much more moderate than those in the foregoing "industrial" communities, the sheer size and importance of these populous communities seemed to warrant continued monitoring for these hazardous emissions. In accordance with a schedule set up by Air Resources Branch, one Station in each of these two cities (#31001 and #51018) has already been selected for surveillance of PAH levels in continuation of this survey.

5) Cornwall and Sarnia

Surprisingly, the Stations selected for Cornwall and Sarnia (#56066 and # 14051, respectively) have shown only insignificant PAH levels in this survey. Both cities are locations of major chemical and petrochemical industries which could be sources for PAH emissions. However, the two-year average BaP and BkF levels for Cornwall were only 0.50 and 1.12 ug/1000m^3 air, respectively, and those for Sarnia were even lower at 0.26 and 0.35.

Because of the possibility of high PAH emissions from industries located in these two cities, despite the low PAH levels recorded at the Stations mentioned above, it was suggested by Air Resources Branch personnel that different Stations (#56051 and # 14055 respectively), located nearer to these industries, be substituted for future surveillance on a low priority basis.

There would appear to be no pressing reason, at the present time, to further monitor PAH levels at the 3 remaining urban Stations investigated in this Survey (#75020 - North Bay, #77016 - Sudbury and #33002 - Highway 401, Toronto).

6) Periods of Temperature Inversion

Dramatic increases in PAH and total suspended particulate, or "dust", levels have been observed in urban communities in Southern Ontario during periods of temperature inversions which lasted between one and four days. Large and industrialized cities, particularly Toronto and Hamilton, were most severely affected with high PAH levels of four to eight times the average two-year levels.

Four major inversion periods were investigated in this study. Other minor incidents of inversions may have remained unreported and in some cases High-Volume filter sampling schedules did not coincide with inversion dates and, thus, filters were unavailable from affected locations during such periods. In consideration of the potential health hazard of high PAH levels as observed during inversion periods, monitoring of these levels on a routine basis in major urban and industrialized communities which are affected would appear to be desirable.

7) Temporary and Localized Pollution by PAH Compounds

As shown by the results from several brief investigations in this report, temporary but nevertheless intensive air pollution by PAH compounds, can occur in populated areas by a

number of man-made causes. These include accidental fires, burning garbage, inadequate refuse-incineration, road-tarring and asphalting operations and last, but not least, rush-hour city traffic. Any of these temporary and usually localized pollution sources can give rise to PAH levels of several hundred times the average levels, in the immediate neighbourhood.

Any large incident of the above nature should be recorded and monitoring of PAH levels from neighbouring Stations should be considered for an assessment of potential health hazards.

8) Seasonal and Environmental Influences

A considerable amount of work has been directed toward establishing seasonal and environmental influences upon PAH levels. The uncovering of any trends in such circumstantial influences would help to arrive at a better understanding of the underlying reasons for the pollution levels observed and, possibly, help to find more efficient means for their control.

A comparison of first year to second year levels of PAH in this survey revealed higher BaP and BkF levels (maximum and average) in the second year for almost all communities investigated. This finding alone makes it seem desirable to continue monitoring PAH levels at least at the "high-level" Stations in order to establish whether the trend toward higher levels is continuing.

Higher PAH levels in the "Cold Season" than in the "Warm Season" were found in the first year for almost all Stations, as would be expected by the additional fuel burning in the winter time. A partial reversal of this trend (still unexplained) occurred in the second year with only four out of eleven Stations showing higher PAH levels in the Cold Season. Generally higher total suspended particulate, or "dust", levels in the Warm Season were found in most communities, as was expected by the influence of vegetation and the absence of extensive snow covers. Exceptions were found in certain highly industrialized areas where increased burning of heating fuel in the Cold Season would have resulted in a corresponding increase in stack emissions of dust into the atmosphere. Similarly, the higher dust levels at Highway 401 in Toronto during the Cold Season could be explained by salt spreading in winter time.

The effect of wind direction on PAH levels was found to be highly significant in most "high level" industrial communities, particularly in Windsor (vicinity of Detroit), Hamilton and Welland, where winds from suspected emission sources coincided with high PAH levels in downwind locations. By contrast, high average wind speeds of up to 20 MPH were found surprisingly ineffective in dispersing PAH pollutants. This finding was quite significant since it could explain why Stations located in the general wind direction from large emission sources showed frequently high pollution levels even at high wind speeds.

The possibility was explored of using the Coefficient of Haze as a measure for PAH levels. However, for most communities, only a vague qualitative correlation seemed to exist, presumably owing to other factors and pollutants which could exert overriding influences upon the COH values. Only under certain extreme conditions, such as during inversion periods, were good correlations found between COH values and the observed PAH levels. On these special occasions, the COH values could be taken as an indicator for high PAH levels.

A somewhat better correlation, at least in many industrial areas, seemed to exist between the total suspended particulate, or "dust", levels and the corresponding BaP and BkF levels. However, this correlation seemed to fail completely in communities with low PAH levels. Generally, it seems that only "dust" generated from certain industries, from which PAH compounds are also emitted (e.g. power plants, steel mills, incinerators), could be useful for estimating the PAH levels in the atmospheres of neighbouring communities.

9) Other Considerations

Average BaP levels reported in this survey for urban communities in Ontario, compared with average BaP levels reported in the literature for cities in foreign countries, show considerable similarity (page 190). As had been pointed out, however, caution must be exercised in accepting some of the foreign data, especially prior to 1968, since they were often obtained by absorptiometric measurement. The required separation of BaP from

BkF and all other interfering PAH compounds was likely unsatisfactory in at least some of these cases. This would bias these BaP values in an upward direction and it would be these higher levels with which the Ontario levels are being compared and found similar.

At any rate, 24-hour averages in BaP levels, as found in this survey at Stations near certain industries and other emission sources, may be cause for concern in any community. Many reports are available in the literature, in which BaP levels hazardous to human health are discussed. There exists considerably discrepancy of opinion in respect to what concentration may constitute a danger level. At the present time no guidelines, criteria or standards are available in Canada. This is also the case in many other countries. Since the purpose of this report was to give an account of analytical work done and of the results obtained in the survey of PAH compounds in urban atmospheres in Ontario, matters concerning aspects of health as a consequence of these findings have not been discussed.

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